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Rural Service Will Help Solve National Problems

ANY steps which encourage decentralization of the population by making rural districts better places in which to live ought to be encouraged by every available means. If electric light and power were generally available in the agricultural regions on which city dwellers must depend, there would be far more encouragement for local industries and better opportunities for building up again those country districts which have fallen upon evil days. General electrical distribution is a powerful factor in making the country attractive to live in and to work in. Rural California, for example, is almost in a class by itself as regards the general use of electricity. If distribution facilities in other parts of the country, more thickly populated and far more easily reached by transmission lines, were anything like so good as they are on the Pacific Coast, centrifugal forces would be set to work, bringing the population outward from the crowded centers to build up anew the prosperity of rural territory.

Are Flat Rates Desirable?

IN THE early stages of each water-power development companies usually offer flat rates for electric service, believing that electricity costs virtually nothing to generate after the fixed charges on investment have been wiped out. While the fixed charges still constitute the greater portion of the cost of generating hydroelectric energy, many companies which have been making flat rates for years now find themselves in the position of having to install more equipment than is warranted by the revenue, because the consumers have increased their load factor. Is it not time to discontinue flat rates, base charges on load factor or go into a straight maximum-demand and energy charge? Some of the water-power companies of the Northwest have chosen to limit the load factor when energy is supplied at a flat rate, hoping that the diversity factor will enable them to continue this form of charge.

Factory Educational Courses Have Definite Limits

FACTORY educational courses give men an understanding of the fundamentals of the specific work they are called on to do, create a greater interest and pride in the work and make for greater efficiency by developing knowledge and ability to think. The courses, however, cannot produce high-class technical men. Their limitations are due to the comparatively small amount of time that can be devoted to such work. If these facts were clearly realized, there would be fewer failures in such industrial courses. Such failures are often caused by attempts to go too far in theoretical subjects while too little in the line of teaching by practical demonstration is accomplished. Concentration on the development of men for the specific tasks they are called upon to perform, with only enough of the theoretical to give them an understanding of the why and wherefore of these tasks, will not only produce better results but will quickly indicate the men who should be assisted to greater development through the technical schools. The picking out of men for further technical education should be one of the aims of factory courses, and to that end industrial managers should co-operate with technical schools in the formation of their courses.

Customer Ownership of Securities

RENEWED interest is being displayed by central-station managers in customer ownership of utility securities. The present financial situation not only makes the plan attractive but its possibilities as a factor in the education of the consumer as to the real place of the utility in the community furnish an even more powerful argument for its employment. It must be realized, however, that the ordinary methods followed by banking houses in placing such securities will not avail. For the most part the users of electric service have little understanding of finance and must be enlightened. Another requisite is that the securities must be safe. A single failure may mean disaster. Moreover, in placing them a steady campaign is necessary. The buyer must be taught that the company has something to offer that is worth while, and his experience must be such that he will come back again and again.

Responsibilities of the Engineer and Construction Man

SO MUCH is heard about the friction existing in many places between construction departments and engineering departments that many have come to think that the situation cannot be changed. The signs of this friction between the construction man, or so-called practical man, and the engineer are lack of co-operation, duplication of work and the feeling of each that the other is intruding on his premises. The results show in waste of material and waste of labor. To deny the existence of this friction is impossible. On the other hand, to give up hope of eliminating it is to block progress in a vital place. Many reasons have been given to explain the existence of the trouble, and much emphasis has been laid on finding the causes, but little attention has been given to remedies. Would it not be well to point out to both sides that their respective rôles are widely different and that with an understanding of the purpose of each kind of work

there might be no reason for conflict? The engineer plans the work; the construction man does the work. No simpler or more complete distinction could be made and none could represent more accurately the conditions that should exist. There is no doubt, even at the present time, that the best results are obtained by such a division of responsibility. All enterprises where such relations and understanding obtain have shown the best efficiency, economy and engineering accomplishment. In other words, experience has shown that one department or one man cannot handle both the planning and the doing of the work as well as two co-operating departments or men can. Not only would absolute impartiality toward both activities be impossible to obtain, but also there would be the difficulty of insuring equal proficiency in both—something very seldom encountered.

It is hardly necessary to point out that many men would be able, with the necessary training, to handle either branch of the work with equal success, and that both branches require their quota of practical experience, engineering knowledge and executive ability. It is therefore in the main simply necessary to realize that either planning the work or doing the work is in itself a job of a scope sufficient to be worthy of undivided effort and promising unlimited accomplishments.

Modern Practice in Transmission-Line Insulation

NO SINGLE element in a complete transmission system surpasses in importance that of line insulation. As a consequence research engineers have in recent years given the closest study to line insulation, in order that the increasing demands of the high voltages of expanding transmission systems may be met. In this field America unquestionably has been the leader and she has contributed largely to knowledge on this important question. An excellent summary of that knowledge and of present American practice in line insulation which should be welcomed by transmission engineers is given in a series of articles by F. W. Peek, Jr., which begin in this issue. The series should prove especially valuable in connection with the plans of the International Electrotechnical Commission for standardization by giving engineers in foreign countries a good understanding of high-tension insulation practice in the United States.

The directions in which recent progress has been made are clearly indicated in the current issue, which also emphasizes how far we still remain from satisfactory and reliable solution. Perhaps the most striking advance lies in the recognition of the importance of the impulse ratio for air gaps and insulators. It is to be noted that this ratio does not have a constant value, but depends on the steepness of the voltage impulse. Nor is the law of variation with steepness of the wave front known. A further uncertainty is the range of steepness of wave which occurs in practice. Notwithstanding these things, great progress has been made in the study of line insulators, and it is now possible to lay down fairly definite principles of design to meet the different classes of disturbance.

Further indication of progress is given in the curve showing the relation between time and puncturing voltage for insulation. The shorter the time of application, the higher the value of puncturing voltage, the puncturing voltage for an indefinite time approaching a definite limiting value. It is shown that repeated applications of a voltage stress not of itself sufficient to cause puncture, but in excess of the minimum breakdown voltage corresponding to indefinite time, will ultimately cause the insulation to fail. These effects are probably due to a localized breakdown within the body of the insulation. This local breakdown is of the nature of ionization with its accompanying electrolytic or thermal decomposition. It results in progressive deterioration leading to ultimate complete breakdown. The same explanation can probably be made of the advantages from the standpoint of impulse ratio of a petticoated insulator over one with smooth surfaces.

Opportunity to Improve Furnace Conditions

THE boiler plant is the department in which the central station producing energy by steam-driven units can effect the greatest economies or suffer the largest losses. It is true that the company which can proceed with the construction of a new plant is in the best position to take full advantage of all the lessons that experience has taught the designer and operator in cutting down boiler-plant losses. This fact should not blind the operator to the fact that the ordinary course of maintenance work in a boiler plant offers numerous opportunities to correct defects in early designs revealed by later experience. One possibility of this sort is in the design of ignition arches. More and more intelligent study is being given to furnace conditions, and many operators are not hesitating, when the course of maintenance work offers opportunity, to change furnace arrangements in the effort to obtain better results in the use of fuel. Even though physical limitations should prevent full use of the knowledge that experience has given the maintenance supervisor would be culpable if he did not do everything possible toward this important end.

Central-Station Industry Cannot Be Accused of Profiteering

SOME features of the post-war situation of a group of central stations are reviewed in the ELECTRICAL WORLD this week on page 1067, with an analysis of the variations in costs, service and profits that have occurred in the last seven years, especially with reference to the period since the armistice. The plants considered are twelve good-sized stations in New England especially typical of the conditions which have come about through the changes in the costs of fuel and labor. The outstanding fact is that the combined rating of these plants has more than doubled since pre-war times, following quite closely an increase in the connected load. Interconnection somewhat bettered the conditions of distribution, and this, with the improvement in diversity factor and a threefold increase in the number of customers, has tended strongly to bring about a better load factor.

The striking increase in the cost of fuel, particularly during the last two years, in which it has doubled, is the principal factor in added expense. This has demanded closer attention to efficiency in the plants, and there has been on the average a decrease of between 15 and 20 per cent in the coal required per kilowatt-hour.

From the standpoint of general improvement the most conspicuous item is the great increase in the

number of customers, showing how year by year, in the stress of war and the even more difficult period following it, electric service has become more and more a vital part of community existence.

After the United States entered the war operating expenses took a sudden jump, and the production costs, as our chart shows, rose so fast that rate increases due to coal clauses and surcharges failed to keep up with their rapid upward shoot. It is very recently that more stable conditions have been reached, and even now it is perfectly clear that prices for electrical energy must still further increase to insure a reasonable return to the utilities. The fact is that the price of electric light and power has risen less since 1913 than any other important product of general use. The central-station industry is about the only one which has steadily played the game and refrained from taking advantage of war conditions to raise unduly the price of its product, and if fuel becomes even more expensive the central stations can come before the commissions with clean hands to ask a fair return upon their necessary capital investments.

Locating Faults on Underground Cables

THE ordinary method of attempting by electrical means to locate a fault in an underground distributing conductor is that of the Varley-loop test. This test, however, requires the use of an intact return conductor back to the testing station. Unfortunately a serious fault in a three-phase underground cable usually causes a rupture of continuity in all the conductors and so prevents the application of the Varley-loop method. In such a case an alternating current of the regular 60-cycle frequency is often applied to the faulty cable at the testing station, and search is then made along the cable for the point at which the inductive effect of this current undergoes sudden variation. Much then depends upon the resistance of the fault. If the fault has a high resistance, the potential at the fault will be almost as great as at the testing station, and the alternating-charging current in the section beyond the fault may be relatively so large as to give very reliable indications.

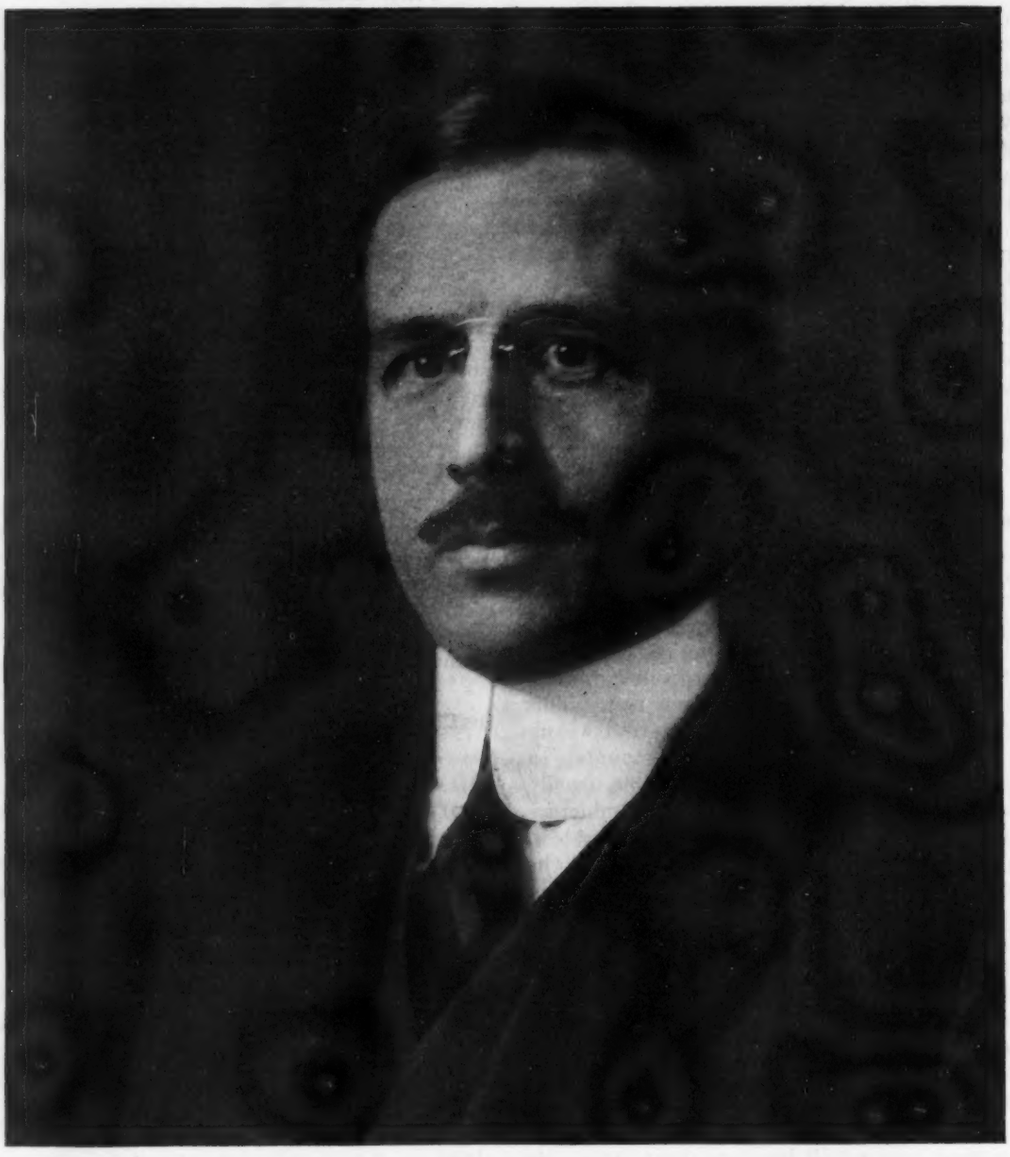
Another method, one which has long been in use, is to send a direct current into the faulty cable from the testing station, with interruptions of very low frequency, and then to make observations with a pocket compass along the cable for the point at which the direct-current magnetic field undergoes sudden variation by reason of the escape of current through the fault. An ingenious modification of this test is described in this number by W. R. Bullard. The testing instrument, instead of being a suspended magnetic needle, is a portable little dynamo-electric machine of such form and dimensions that the field magnet can be made to straddle the faulty cable. When the direct current flows through the cable this current magnetizes the little hand-driven dynamo and causes it to generate a detectable electric current, whereas when the cable current is interrupted the field excitation is lost and only residual magnetic effects are produced. If the direct current in the cable and consequently the indications fall below a certain value, owing to high resistance in the fault, the indications may be magnified above stray disturbances by a simple and ingenious expedient explained in the article.

Interior Wiring for Farm Buildings

HOW interior wiring on the farm, particularly for barns and buildings other than residences, should be done needs careful consideration. Recently the Industrial Commission of Wisconsin issued a bulletin calling attention to the advisability of all wiring in such buildings being placed in conduit, but an informal discussion of the bulletin has shown the existence of troubles that indicate the need of careful investigation as to the kind of installation it is advisable to make. In stables particularly, the fumes from animal wastes have had a detrimental effect on conduit. In winter weather some cases of serious condensation in conduit installed in a stable have been encountered, and in one case at least an inspector has raised the question whether open wiring, guarded from contact by individuals and from mechanical injury, is not preferable to conduit work. The use of brass in place of porcelain sockets and ordinary snap switches in place of weatherproof switches is a practice all too common. The fire hazards involved are unusual because of the presence of large quantities of loose hay and straw and the general use of timber construction. The subject should receive careful consideration with a view to modifying existing practices to meet such new conditions as may be discovered.

Installations Should Facilitate Future Repair

SOME extremely useful hints on the care and repair of hydraulic turbines are given this week in a paper by L. W. Wyss. Turbines used to be installed, apparently, on the theory that eternal life was theirs, and it was very unusual to find proper facilities for getting at the runners and other internal parts of the equipment with facility. Sometimes on account of the particular hydraulic situation existing it was not even easy to provide for a necessary shutdown. Few are aware how great the improvements in turbines have been within the last twenty years—improvements quite comparable with the gains that have been made in substituting steam turbines for reciprocating engines. The same changes for the better in a similar degree have come about in the installation, and it is now very rare to find more than two runners on the same shaft, or a collection of rattletrap gears in the main drive. Mr. Wyss lists the things which must be looked into when time comes for inspection or repairs of the turbine, laying particular stress on the need of cutting as short as possible the time required for the operation. This implies very complete preparation for every mechanical move that has to be made, in order that once the turbine is shut down it may be promptly opened up and the parts handled as necessary. The water turbine is, in fact, an extremely durable and reliable prime mover, but if anything does happen to it the results are likely to be serious and to put the unit out of service for some little time. Mr. Wyss' suggestions make it very evident that today in installing hydraulic turbines for power service the installation should be designed at the start so that repairs shall be easy instead of difficult or well-nigh impossible, and the whole plant should be arranged so as to cause the minimum disturbance to service by the shutdown of a single turbine for the brief period which should be all that is necessary thoroughly to overhaul it.



Gano Dunn

An engineer of the highest type who, besides excelling in invention, design and construction, is an executive with a broad conception of engineering social endeavor which has made him a dominant figure in the profession

STRAIGHT thinking combined with a sympathetic nature and a charming personality makes for leadership. Thus it is with Gano Dunn. As an engineer he has made many original contributions to electrical design and application. As an executive he has led great organizations with sympathy and resourcefulness through many important developments. But in addition he has unselfishly given freely of his time and effort to engineering association activities in order that greater progress could be made by the entire profession. Directly upon graduation from Columbia University in 1891 as an electrical engineer he became an apprentice in the Crocker-Wheeler shops. This company was then in its infancy, and Mr. Dunn grew up with it, being successively assistant engineer, chief engineer and later vice-president and director. With this organization he was engaged principally in the design of electrical apparatus, and later as an executive he had direct supervision over this phase of the company's work. For a long time he gave especial attention to the industrial application of electric power, the company being one of the pioneers in the application of the electric motor to machine tools and to industrial purposes generally.

Toward the end of 1911 Mr. Dunn left the manufacturing field to engage in consulting engineering practice as a director and vice-president in charge of engineering and construction of J. G. White & Company. In 1913 he became president of the J. G. White Engineering Corporation, in which work he is now engaged.

Because of his exercise of his inventive ability the industry has become the richer. Patents have been granted to him on the structural features of the generator, motor, rheostat and heavy-power switch and on systems of operation, control and speed regulation. Among the latter is a system for operating heavy-duty two-high reversing roll trains in steel mills whereby almost instantaneous reversals of full speed can be secured without imposing heavy peaks on the energy supply system.

It is in the field of engineering social endeavor, perhaps, that Mr. Dunn has been of broadest service to the profession. This is probably best indicated by a brief recital of some of the more important appointments he has held, namely: president American Institute of Electrical Engineers, 1911-12; president United Engineering Society, 1913-16; vice-chairman National Research Council, 1917; chairman Engineering Foundation, 1915-16; vice-president International Electrical Congress at Turin 1911; member War Department nitrate commission, 1916-18; member engineering committee of the Council of National Defence, and member American Committee of International Electrotechnical Commission. He also assisted in organizing the International Electrical Congress in St. Louis in 1904 and was secretary of the section on electric lighting and distribution.

Although Mr. Dunn has been prominently active in the industry for so long a time, it cannot be said of him that he has grown old in the service. It was only a month ago, on Oct. 28, that he celebrated his fiftieth birthday.

Locating Faults on Underground Cables

Direct Current Used for Tracing Instead of a Pulsating or Alternating Current—Effect of Capacity, Resistance of the Fault, and Stray Currents Eliminated—Method May Be Used on Live Circuits

By W. R. BULLARD

United Electric Light & Power Company, New York City

THERE are many schemes used for locating faults on underground cables, such as the bridge or loop method and the use of various tracing currents. All of these methods, however, have had certain limitations due to the effect of capacity, resistance of the fault, stray currents and other similar factors. Owing to these limitations on previous methods the United Electric Light & Power Company of New York City has developed a scheme for using direct current for tracing that has given accurate results for practically all conditions of faults found in underground cables.

Limitations of the Bridge Method

For the proper use of the bridge method it is required that the conductor on which the fault is located shall not be burned apart, and also that a clear conductor of the same length and of approximately the same size, running between the two points which constitute the ends of the conductor at fault, shall be available. This is not always the case. For instance, in the case of a three-conductor feeder, all three conductors may be short-circuited and grounded, or one or more of them may be burned apart, and no other feeder of the same length running between the same two points may be available at the proper time. Furthermore, the bridge method can never be used when the cable or circuit at fault is alive on high potential.

In cases where one or more conductors are burned apart but not grounded the fault can be approximately located by measuring the capacity of a conductor on either side of the fault. This method will not apply, however, if the two sections of the conductor are grounded.

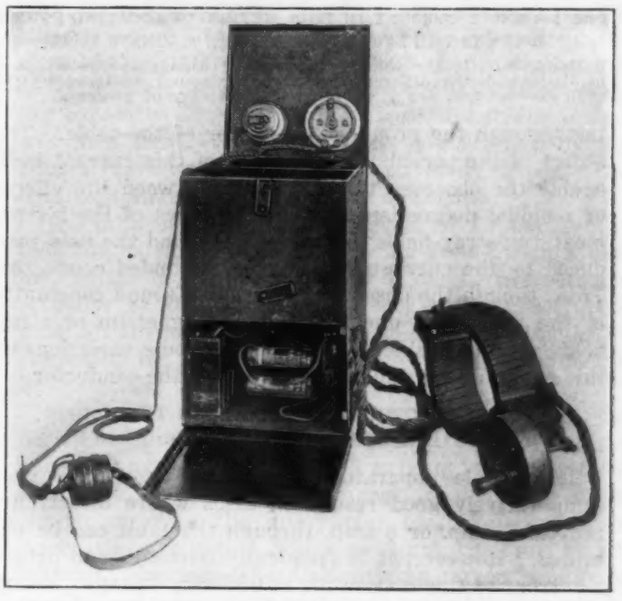
Effect of Pulsating Currents

Owing to the limitations of the resistance and capacity methods, various methods have been devised for locating faults by passing alternating or pulsating current through the conductor to the fault and then with an exploring coil and telephone receiver, or some similar form of detector, proceeding to test for the presence of the tracing current at various points along the cable. This is done until the fault is passed, when under the proper conditions the tracing current will disappear. This method is fairly satisfactory under all conditions involving a ground of very low resistance on one or more conductors or a short circuit of very low resistance between two or more conductors. But in cases involving high or moderate resistance of grounds or short circuits the method quite frequently fails. This is due to the fact that under conditions of moderate or high resistance a potential is set up at the fault by the tracing current, and this potential causes a current to flow beyond the fault, owing to the capacity between conductor and ground or between two conductors.

In practice this defect has proved to be so serious that the method in itself has come to be regarded as almost entirely non-dependable. Gross errors in indicating the location of faults have come to be regarded as the rule rather than the exception. For instance, in one particular case involving a three-conductor feeder approximately 1½ miles (2.4 km.) in length a fault occurred in the section immediately outside of the station, at one end of the feeder. Interrupted direct current was applied from the station and indications were obtained at points along the feeder almost to the opposite end, thus giving an indication almost 100 per cent incorrect.

The Direct-Current Method

The ideal form of current for use as tracing current is that involving no changes of value, or, in other words, direct current. But for this form of tracing current it is obvious that some method of detection other than the ordinary exploring coil must be used. A method of detection for use on direct current has been developed. The elements of this method are shown in Fig. 1.



DETECTOR SET DEVELOPED BY UNITED ELECTRIC LIGHT & POWER COMPANY FOR LOCATING CABLE FAULTS WITH DIRECT CURRENT

Direct current is applied from one end of the feeder in a manner similar to that used in the case of alternating current. An interrupter is used, but the period of interruption is very slow, being in the neighborhood of two seconds for each complete cycle. That is, the cycle consists of a period of one second on and one second off. It has been found that with this period of interruption the capacity effect of the cable is entirely negligible, and no matter how high the resistance of the fault may be, no current in the conductor beyond the fault can be detected by ordinary methods, except perhaps a click in the telephones at the instant of making or breaking the circuit.

The principal element of this system is found in the detecting instrument shown in the upper right-hand part of the illustration. Basically, this is a generator, either alternating current or direct current, having a field which consists of two halves of soft iron. This field is arranged to clamp around the cable. The armature is revolved by means of a crank and gears, and the resulting emf. is impressed upon a telephone receiver. The field is excited by the direct current passing through the grounded conductor of the cable. The object of the periodic interruption of this current is to enable the observer to distinguish between the effects of residual magnetism in the field pieces of the instrument (or stray fields in the vicinity) and the field produced by the current through the grounded conductor. Thus, though the observer may hear a sound constantly in the telephones due to residual magnetism or stray fields, still he is able to detect the periodic variations of this sound due to the current through the conductor.

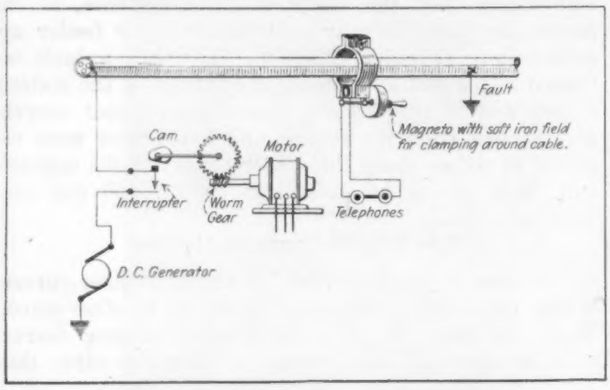


FIG. 1—DIRECT CURRENT IN THIS METHOD OF LOCATING FAULTS PRODUCES THE EXCITATION FOR THE MAGNETO FIELD

The circuit is periodically interrupted to enable the observer to distinguish the difference between the sound produced by the fault current and any stray currents that may be present.

DETECTING APPARATUS FOR THE DIRECT-CURRENT METHOD

The simple apparatus, shown in Fig. 1, will give comparatively good results in cases where direct current of 6 amp. or 8 amp. through the fault can be obtained. However, it is frequently impossible to obtain a current of this magnitude at ordinary voltages, owing to the fact that the resistance of the fault is quite often comparatively high. In order to detect currents of smaller magnitude than this, it has been found necessary to make certain additions to the detecting apparatus. A diagram of the complete apparatus, using a telephone receiver as the indicator, is given in Fig. 2.

The generator has a comparatively low speed and if slip rings were used would give an alternating current of about 15 cycles when the crank is turned at a moderate rate. Instead of slip rings a two-segment commutator is used, which gives a unidirectional emf. with a corresponding frequency of pulsation. The peaks of this emf. are smoothed out by means of a condenser. Since the frequency of 15 cycles or thirty pulsations is too low for good audibility, an interrupter in the form of a buzzer operated by a small battery has been added to make and break the telephone circuit. In addition to this a coil for neutralizing residual magnetism or stray fields due to direct current flowing through the sheath of the cable has been added.

This coil is excited from a battery similar to the one which operates the buzzer, and the current is adjusted by means of the rheostat shown in the lower part of Fig. 2. By means of the coil and this rheostat a flux passing through the field pieces of the instrument in either direction can be neutralized if constant. The procedure is the first to clamp the instrument around the cable and then to revolve the armature and listen for constant sound in the telephones. The rheostat is then adjusted for minimum constant sound. As soon as this is done the periodic rise and fall of sound due to the tracing current can be heard. It will be noted that the same switch which is used to open the buzzer circuit also opens the neutralizing coil circuit. This provides against leaving the neutralizing circuit closed and thereby exhausting the battery, for the buzzer will give a warning sound until the circuit is opened.

The first outfit of this type was placed in service in June, 1920, and the complete apparatus is shown in the photograph. The complete outfit is contained in a sheet-metal case, which also provides mounting for the switch, rheostat, batteries and buzzer.

The inside diameter of the field pieces when closed is approximately 6 in. (15 cm.), which permits the apparatus to be clamped around three-conductor cable having a protective covering of cement. The gears are inclosed in a protective case of sheet brass. The buzzer is mounted on leather straps in the lower part of the case to reduce noise. With an outfit of this type it is practicable to detect tracing current of the order of 2 amp. or 3 amp. The telephone receiver as an indicator has the advantage of simplicity, ruggedness and sensitivity. However, its use involves several objectionable features, as enumerated below:

1. It is practically impossible to reduce the constant sound in the receivers to zero. This is due to the fact that while it is possible to reduce the average value of unidirectional current to zero, still, owing to local magnetic circuits in pole faces and residual magnetism in the armature itself, a certain amount of fluctuating current will remain in the telephone circuit, regardless of the position of the neutralizing rheostat.

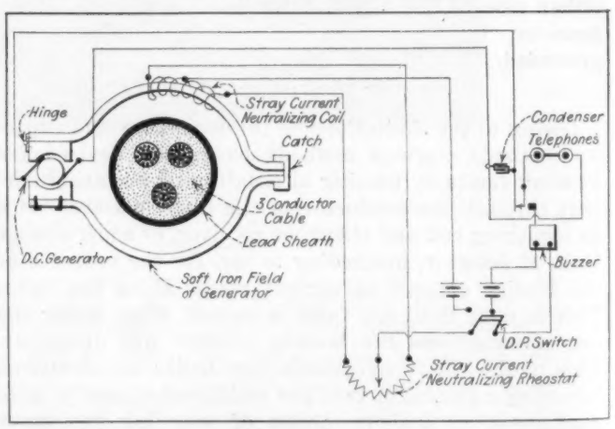


FIG. 2—DETECTING APPARATUS USED WHERE FAULT CURRENT IS OF LOW VALUE

2. The use of telephone receivers does not provide an exact measurement of the amount of tracing current. It is important to obtain such measurement because of the presence of tracing current flowing along the sheath of the cable, as will be shown further on.

3. When telephone receivers are used the stray current neutralizing coil does not provide for neutralizing

stray alternating current in the sheath of the cable or stray alternating fields. This is taken care of to some extent by the condenser shunted across the armature terminals. But it is impossible entirely to neutralize stray alternating current of a certain character without the use of condensers of large size, which would make the apparatus cumbersome. These difficulties are overcome by the use of a direct current millivoltmeter as an indicator, as shown in Fig. 3.

Since the moving element of the millivoltmeter cannot follow the fluctuations of induced alternating current of the usual frequencies or the fluctuations produced by the revolving armature of the instrument, a true indication of the average unidirectional current is given, and disturbances produced by stray alternating fields, or stray alternating current in the sheath of the cable, are entirely eliminated. Furthermore, the swings of the needle, due to the periodic application of tracing current, give a fairly accurate indication of the amount of tracing which is flowing through the cable. Of course, the amount of indication varies somewhat with the speed at which the crank of the instrument is turned, but it is not necessary to time this speed accurately in order to obtain the degree of accuracy which is required for practical purposes.

In order to use the detector set with a millivoltmeter, the instrument is clamped around the cable, the armature then being revolved and the neutralizing rheostat adjusted until the average indication of the needle is in the neighborhood of zero. The instrument used is one which has the zero point in the center of the scale. After the rheostat is adjusted the observer continues to turn the crank, and if he should be between the point of application of tracing current and the fault, the needle of the millivoltmeter will periodically swing first to one side of zero and then the other, following the periodic application and removal of the tracing current made by the motor driven interrupter.

VARIABILITY OF STRAY CURRENT AND STRAY FIELDS CAUSES TROUBLE

The instrument shown in Fig. 3 can without difficulty be constructed for almost any degree of sensitivity. In fact, it can be constructed to detect direct current of the order of a small fraction of an ampere. The sensitivity is only a question of size and material of pole pieces, winding of the armature, speed of armature and sensitivity of the millivoltmeter. In practice the limiting factor has been found to be the effect of stray fields and stray direct current in the sheath of the cable. A stray field, if constant, can be neutralized in practically any amount by means of the stray-current neutralizing coil. However, under conditions encountered ordinarily there are always fluctuations in stray fields and stray current. This is due to changes in load on circuits carrying direct current, changes in stray ground currents due to passing trolley cars, and other such causes as these.

Under conditions encountered in the business districts of New York City it has been found that fluctuations of stray current will be encountered of such magnitude as to render the indication of tracing current somewhat uncertain, if the value of tracing current is reduced to less than approximately 1 amp. However, in certain cases current as low as 0.5 amp. has been used. In the majority of cases it is not difficult to obtain 1 amp. or more through the fault at 120 volts direct current. If the resistance of the fault is of such value as to limit the current to less than 1 amp., it is usually possible to decrease the resistance of the fault by applying high potential for a short length of time and thereby burning the fault to a lower resistance.

If the interrupter shown in Fig. 1 be replaced by a reversing switch, and if the current be reversed at each operation of the switch, instead of interrupted, the effect on the millivoltmeter of Fig. 3 will be doubled, reducing the amount of tracing current required for positive operation to 0.5 amp. instead of 1 amp.

PENDULUM METHOD OF ELIMINATING FLUCTUATIONS DUE TO STRAY CURRENT

Occasionally faults are encountered where the resistance is so high as to limit the tracing current to a small fraction of an ampere at ordinary voltages of direct current and where it is practically impossible to reduce the resistance of the fault by burning with high potential. In cases of this kind it is usually impossible to locate the fault by means of the apparatus described above without certain modifications, for in such cases the fluctuations due to stray current are of sufficient magnitude to drown out the fluctuations due to tracing current. However, the effects of stray current can be considerably reduced by "tuning" the millivoltmeter to correspond with the period of the applied tracing current. The fluctuations caused by stray current will then remain constant, while those caused by the tracing current can be multiplied many times. The details of the tuned method are as follows:

The millivoltmeter must be devoid of all damping so that the moving element will swing freely with a natural period in the neighborhood of one or two seconds. A meter of this type can be very easily constructed from an ordinary D'Arsonval type of millivoltmeter by rewinding the moving element on a frame of non-metallic material.

Some provision must be made for adjusting the period of the instrument by changing the length of the spring or by moving adjustable weights toward or from the pivot of the moving element, or by some other similar means. The interrupter must have an absolutely constant period, which need not, however, be adjustable. In cases where alternating-current supply of very close frequency regulation is available, this can be accomplished by using a synchronous motor to drive the interrupter.

Another alternative is the use of a pendulum contact. This method is under development at the present time, and it is not known to what limits it may be carried under practical conditions. However, it has been possible during laboratory experiments to multiply the indication of an instrument by 80 or 90 by the application of current periodically, with a frequency corresponding to the natural period of the instrument. It is believed that after this method is fully developed, it will be possible to detect a periodic tracing current of the order of a very small fraction of an ampere under the conditions of stray current interference which are usually encountered.

In all cases of faults on transmission feeders where one clear conductor of the same feeder or a similar conductor of the same length running between the same two points is available the bridge method of testing should be used to approximately locate faults.

A test of this kind, however, should be depended on only for an approximate location. For instance, in the case of a transmission feeder of 8 miles or 10 miles (13 km. or 16 km.) length, a bridge test should locate the fault within 1,500 ft. (450 m.) or 2,000 ft. (600 m.), if conditions are favorable. This test should then be supplemented by the direct-current tracing-current method, and the indicator described above should be used in the vicinity of the location indicated by the bridge method to determine definitely the section of cable in which the fault is located.

In case two or more conductors are burned apart and grounded, or in cases where all three conductors of a three-conductor feeder are short-circuited or grounded, it will usually be impossible to use the bridge method of location. In such cases, if one or more conductors are grounded at the fault, it is possible to locate the fault accurately by means of the direct-current tracing-current method.

TRACING GROUNDS ON LIVE CIRCUITS

In the case of ungrounded high-tension circuits where single-conductor cable is used, quite frequently one conductor may become grounded without affecting the other conductors, and in such cases (on distribution circuits for instance) it may be desirable to keep the

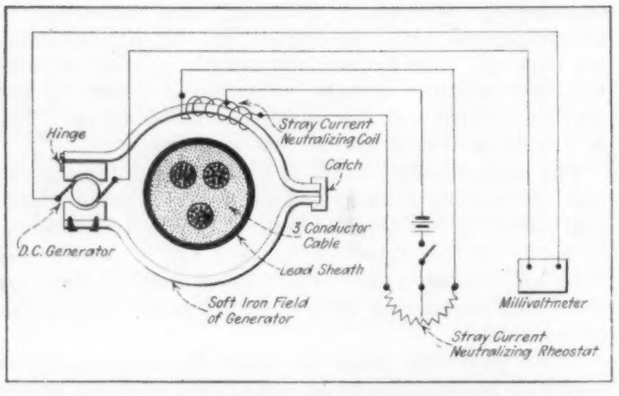


FIG. 3—A MILLIVOLTMETER GIVES BETTER RESULTS AS AN INDICATOR THAN THE TELEPHONE RECEIVERS

circuit in service while locating the fault. The direct-current tracing-current method of fault location offers a very suitable means for locating a fault of this kind.

If the connections in Fig. 3 are used, the indication is not affected by the alternating-current fields, and hence the load current flowing in cable will not interfere with the work of locating the fault. However, in cases of this kind it is necessary to clamp the instrument around all three conductors of a three-phase circuit in order to avoid error due to tracing current passing through the transformers or other apparatus which may be connected to the circuit.

The above method of locating faults depends upon obtaining a ground on one or more conductors at the fault. In a case where short circuit occurs between two conductors with no ground, the system is not well suited to hunting the trouble, for the tracing current returning from the fault over the other conductor almost or entirely neutralizes the effect of the conductor current from the point of application to the fault.

In other words, in case of a short circuit between two or more conductors without a ground the application of very high values of tracing current is necessary to give an indication. However, owing to the physical characteristics of the cable, almost any type of fault will in the majority of cases cause a ground on one or more conductors, and in most cases where a ground is not formed a ground on one or more conductors at the fault can be obtained by applying high potential between the conductors and ground and thereby burning the insulation, which in all probability is already partially charred.

The proper operation of the direct-current tracing-current method, therefore, depends upon conditions which will cause the tracing current to pass away from the cable into the ground at a point very near the fault. This is usually the case in systems where iron ducts are used, but in systems using tile duct cases are quite frequently encountered where a large portion of the tracing current passes into the lead sheath of the cable and continues along the sheath for a considerable distance in either direction or both directions from the fault.

In duct systems where cases of this kind are likely to occur it is necessary to use some method of detecting the sheath current and distinguishing it from the tracing current flowing through the conductor. Heavy copper clamps are placed around the conductor at points as widely separated as possible (in a manhole this will, of course, be at opposite duct edges), and these clamps are connected together by a heavy copper shunt.

Owing to contact resistance of the copper clamp it is usually impossible to reduce the sheath current to a negligible value in case it is present in any large amount. However, a noticeable reduction is obtained, and by opening and closing a switch in the shunt the comparative amount of sheath current can be determined. If the indication of the millivoltmeter is reduced when the switch is closed, this indicates that the instrument is indicating sheath current only, and hence the location at which the reading is being taken is beyond the fault. If when the switch is closed the indication of the millivoltmeter is increased, this indicates that the instrument is reading both conductor current and sheath current, and that the location at which the reading is being taken is between the point of application and the fault.

As a final and accurate check on sheath current, the effect of this current can be entirely eliminated by cutting a ring out of the sheath at a point on each side of the place where the fault is suspected to be. In case the fault is not found to be at the suspected location, the lead can usually be replaced without disturbing the insulation or making a new joint. If the fault is at the suspected location, no cable except that at the faulty section will be involved and it will not be necessary to replace the lead.

The direct-current method never fails to locate a fault surely and accurately if a sufficient indication can be obtained to overcome stray-current fluctuations and if sheath current is properly taken into account. Furthermore, direct comparison between the use of direct current and alternating current or pulsating current has repeatedly shown the former method to be far superior to the latter in the matter of accuracy.

As an example might be given the case mentioned in the first part of this article where the pulsating current method gave an indication nearly 100 per cent incorrect. In this case direct-current tracing current was applied to check the results obtained, and the fault was at once located at the opposite end of the feeder.

Transmission-Line Insulation in America

A Full Discussion of the Factors Affecting Spark-over and Puncture Voltages of Insulators and Bushings—Experience with Porcelain Insulators and Tests for Predicting Their Performance

By F. W. PEEK, JR.
Consulting Engineer General Electric Company

TO ASCERTAIN if there are sound theoretical, practical and economic reasons for the line-insulation standards which have grown up in America, the writer has made a thorough study and presents his findings here. In making this survey it was borne in mind that theory and practice agree if theory contains all of the variables of practice. It is not always possible to anticipate all of the variables of practice in laboratory work. Laboratory and theoretical work, however, admit of a logical start in any new field and, coupled with practical observation and experience, result in the best conclusions.

Modern standards require uninterrupted service. Line insulation must be selected accordingly. In this connection it is very important to have certain standard steps in voltage. These should be as few as possible and preferably in multiples of a given voltage. The object is, of course, the possibility of good insulation at a minimum of cost and minimum time of replacement in case of trouble.

The factors determining the spark-over and puncture voltages of insulators and bushings will first be discussed as it is necessary to bear these in mind while drawing conclusions regarding the desirability of any standard routine or design tests.* This information, coupled later with a consideration of the results of practical operation, will make it possible better to decide the value of standard tests as a criterion in anticipating the suitability of insulators for a given duty.

The main insulation of any transmission line is the air in which the conductors are immersed. It seems appropriate, therefore, to discuss the subject of corona in the final section.

Effect of Lightning on Insulators

Insulators of different designs may have equal normal frequency spark-over voltages but greatly different impulse or lightning spark-over voltages.† This is because a definite but very small time is required for a spark to form which depends upon the design and upon the rapidity at which the voltage is applied. Higher voltages are required in the case of lightning, where the voltages are applied very rapidly and the time is, therefore, limited. Such rapidly applied voltages are said to have steep wave front. Spark-over does not occur when the normal frequency spark-over voltage is reached by the rapidly increasing impulse voltage, but some time later when this voltage has reached a higher value.

Referring to Fig. 1, the spark-over voltage of a given insulator is e_1, and always practically constant, if the time of application is not limited. Spark-over may take place after the continuously applied voltage e_1 has been on for some time t_1. If a voltage increasing at a rapid rate as represented by A, in Fig. 1, is applied, spark-over will not take place when the continuously applied spark-over voltage e_1 is reached, as the time t_1 is required at this voltage. The spark will begin to form when the voltage reaches the value e_3, however. The voltage will, therefore, rise above e_3, and spark-over will take place after the time t_3 has elapsed and the voltage has risen to e_2. When the voltage is applied at a more rapid rate along wave B, the spark, as before, will begin to form when voltage e_1 is reached. The voltage will continue to rise and reach the value e_3 during the time t_3 before spark-over occurs. Thus, on account of the time lag, when voltage is applied at a very rapid rate, as by an impulse, spark-over does not occur when the continuously applied breakdown voltage is reached. The voltage "overshoots" this value during the time that rupture is taking place. The excess in voltage is greater and the time lag less the greater the rate of application. The time lag for any given gap or insulation has thus not a fixed value but depends on the wave shape of the impulse or rate of application of the voltage. In making a study of such phenomena it is necessary to use certain definite wave shapes. The ratio between the impulse spark-over voltage and the normal frequency spark-over voltage has been termed the impulse ratio.

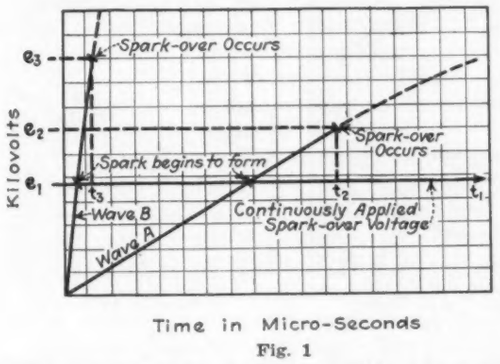


Fig. 1

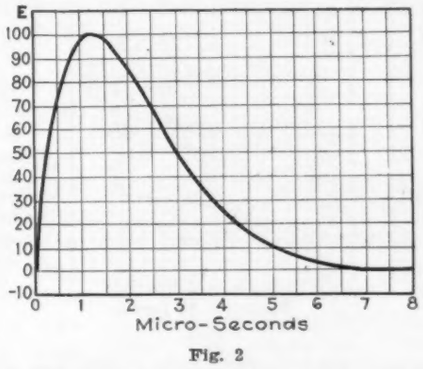


Fig. 2

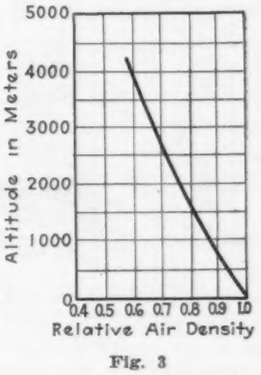


Fig. 3

FIG. 1—IMPULSE SPARK-OVER VOLTAGE IS HIGHER THAN FOR NORMAL FREQUENCY. FIG. 2—200-KILOCYCLE IMPULSE WAVE. FIG. 3—VARIATION OF AIR DENSITY WITH ALTITUDE

*Spark-over—an arc, or spark, over the insulator surface through the air; puncture—electrical breakdown of the solid insulation.

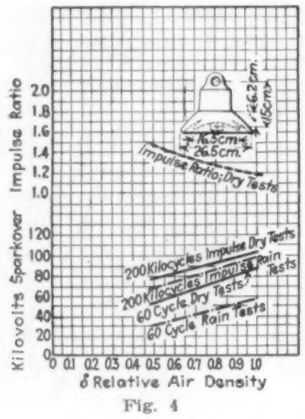
†Normal frequency—any low operating frequency as, for instance, 60 cycle; lightning voltages—time of application in the order of a millionth of a second or micro-second.

TABLE I—IMPULSE SPARK-OVER OF INSULATORS

No.	Type	Spark-Over Kv., 60-Cycle Dry	Spark-Over Kv., 60-Cycle Wet	Impulse Spark-Over Kv. (Single Half-Cycle, 200 Kilocycles Sine Wave) Dry	Impulse Spark-Over Kv. (Single Half-Cycle, 200 Kilocycles Sine Wave) Wet	Impulse Ratio
1	Petticoat	100	67	142	140	1.42
2	Smooth	100	50	105	105	1.05

The impulse ratio is very high for steep wave fronts and approaches unity for "low-frequency" surges. For a given impulse the impulse ratio is lower for smooth insulators than for insulators with properly designed petticoats or corrugations. An example of the variation of the impulse ratio for two different insulator designs is given in Table I.

It will be noted that although both insulators have the same 60-cycle or normal frequency spark-over voltage, the "lightning" spark-over voltage of insulator No. 1 is about 40 per cent higher than the "lightning" spark-over voltage of insulator No. 2. The impulse used was a single half-cycle of a 200-kilocycle wave as shown in Fig. 2. With a steeper impulse the difference


Kilovolts Sparkover Impulse Ratio
δ Relative Air Density
Impulse Ratio; Dry Tests
200 Kilocycles Impulse; Dry Tests
200 Kilocycles Impulse; Rain Tests
60 Cycle; Dry Tests
60 Cycle; Rain Tests
Fig. 4

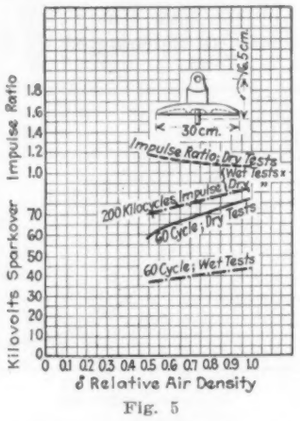
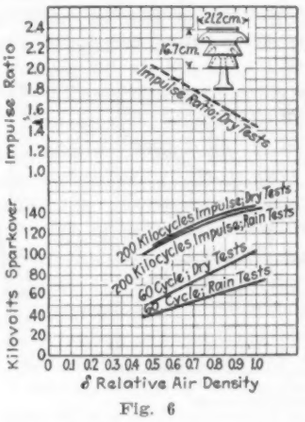
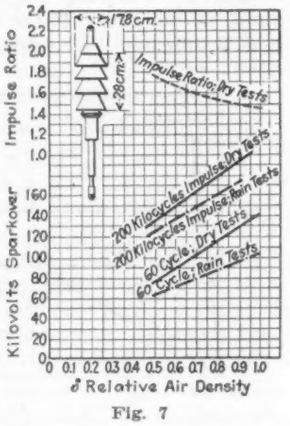


Fig. 5


Kilovolts Sparkover Impulse Ratio
δ Relative Air Density
Impulse Ratio; Dry Tests
200 Kilocycles Impulse; Dry Tests
200 Kilocycles Impulse; Rain Tests
60 Cycle; Dry Tests
60 Cycle; Rain Tests
Fig. 6


Kilovolts Sparkover Impulse Ratio
δ Relative Air Density
Impulse Ratio; Dry Tests
200 Kilocycles Impulse; Dry Tests
200 Kilocycles Impulse; Rain Tests
60 Cycle; Dry Tests
60 Cycle; Rain Tests
Fig. 7

FIGS. 4 AND 5—SIXTY-CYCLE AND IMPULSE SPARK-OVER CURVES FOR SUSPENSION INSULATORS. FIGS. 6 AND 7—SIXTY-CYCLE AND IMPULSE SPARK-OVER CURVES FOR PIN INSULATOR AND TRANSFORMER BUSHING

would be greater. Lightning would be less likely to cause spark-over of insulator No. 1. Rain does not greatly decrease the lightning spark-over voltage. Because of this the probability of failure due to steep-wave-front disturbances is greatly decreased. For "low-frequency" surges the wet spark-over voltage approaches the 60-cycle wet spark-over voltage. The effect of steepness of wave front may be seen by reference to Table II.

In practice the lightning-arrester gap should have a low impulse ratio, the line insulators and bushings a high impulse ratio. In fact, the author's attention was first called to this phenomenon on an operating line. A bushing was "protected" by a horn gap set at about half the 60-cycle or normal-frequency spark-over voltage of the bushing. Lightning always caused the bushing to spark over. It was found that the lightning spark-over of that particular design of bushing was less than the lightning spark-over voltage of the horn set at half the 60-cycle spark-over voltage of the bushing.

EFFECT OF ALTITUDE ON SPARK-OVER VOLTAGES

The spark-over voltage of an insulator or bushing decreases with the air density, or pressure and temperature. At high altitudes where the barometric pressure is low the spark-over voltage is much lower than at sea level. Generally the spark-over voltage decreases approximately as the air density. A curve of variation of air density with altitude is given in Fig. 3. The values of δ, or correction factor, are in terms of unity at 76-cm. barometer (30-in.) and 25 deg. C. Thus, from this curve the approximate spark-over voltage at 5,000 ft. (1,500 m.) altitude would be 82 per cent of the spark-over voltage at sea level (25 deg. C.).

The correction factor is calculated as follows:

$$\delta = (3.92b) \div (273 + t),$$

where

b = barometric pressure in centimeters,

t = temperature in deg. C.

If e is the spark-over voltage at sea-level at 25 deg. C., the spark-over voltage at some other value of δ is

$$e_1 = \delta e$$

Rain greatly lowers the 60-cycle spark-over voltage of insulators but has very little effect on the impulse spark-over voltage for steep wave fronts.

Figs. 4, 5, 6 and 7 give the wet and dry 60-cycle and impulse spark-over voltages for typical designs at various air densities. The voltages are in terms of root-mean-square or effective values. Altitudes corresponding to δ may be found from Fig. 3. These tests show that the ratio between the 60-cycle dry and rain spark-over voltages remains approximately constant for different values of δ.

Figs. 4, 5, 6 and 7 show also that the steep wave front impulse spark-over voltage is not greatly lowered by rain. The impulse ratio increases with decreasing δ.

DUST AND SALT LOWER SPARK-OVER VOLTAGE

Insulators and bushings are occasionally placed where they become coated with dust, salt, etc. When the coating becomes moist the spark-over voltage is very low. This is especially bad when the moisture is due to fog or condensation as the whole surface of the insulator becomes coated and conducting. The break-down voltage is then quite low. Condensation of moisture on a

TABLE II—IMPULSE SPARK-OVER OF SUSPENSION INSULATORS

	60-Cycle Spark-Over Kv. Dry	60-Cycle Spark-Over Kv. Wet	100-Kilocycle Impulse Spark-Over Dry	100-Kilocycle Impulse Spark-Over Wet	500-Kilocycle Impulse Spark-Over Dry	500-Kilocycle Impulse Spark-Over Wet
A Two-piece suspension with petticoats	112	72	118	114	165	162
B Two-piece suspension with petticoats	116	70	128	125	172	168

clean insulator generally does not seriously lower its strength.

In making rain tests the spark-over voltage varies considerably with the resistance of the water. It is generally desirable to use water with a specific resistance of about 10,000 ohms per centimeter cube or higher.

CAUSES FOR DETERIORATION OF PORCELAIN

The apparent deterioration of porcelain is generally due to one of the following causes:

1. Gradual mechanical cracking due to expansion of cement or tight-fitting metal parts, or to internal firing strains or brittle porcelain.
2. Gradual absorption of moisture due to porosity.

The greater part of the trouble has been due to cracking under stresses caused by expansion of cement or of tight-fitting or cemented-in metal parts. Cracking may also be caused by uneven expansion in very thick porcelain parts of different shapes.

Mechanically, porcelain would never be selected as a line support. It is unreliable in tension, subject to cracking, and if made in large pieces subject to porosity. The greatest care is necessary in manufacture to secure a uniform, tough, non-brittle material, free from porosity. Unfortunately it is the only material known at the present time that will withstand the weather without the carbonization and deterioration of organic compounds under the electrical stress.

Often after three to five years of more or less successful operation insulators selected by the most careful electrical tests begin to fail.

The foregoing causes of deterioration are well verified in practice because the type of insulator in which the porcelain units are strung together by loose-fitting metal parts or cables shows no deterioration after ten years or more of service. This was found to be true even in some of the earlier units made of poor material. The absorption of moisture seems to be due to a considerable extent to breathing. The presence of a damp sponge of cement is thus also undesirable from this standpoint as it keeps moist the air breathed by the porcelain.

The solution of the deterioration problem seems to be to start with a design as free as possible from expansion troubles and the selection of a tough, non-porous porcelain. Years of service have been the best criterion of design. Regarding the selection of material, no present practical electrical test will anticipate future cracking due to internal strains or brittle porcelain or will indicate porosity in dry porcelain. The desired results can probably best be attained by testing a small percentage of the product to destruction from day to day after the usual electrical and inspection tests have been made, the object being to determine if the product is up to the standard and of uniform quality. This idea is not new but is used in the manufacture of lamps and in other industries. Electrical, mechanical and porosity uniformity tests are necessary. Extremely accurate tests are not necessary, but it is necessary to have tests that can be quickly made so that any fault can be at once detected and remedied.

In our investigations we made first the electrical tests, followed by mechanical impact tests to destruction. Samples were then taken from the head and thick parts of the units and subjected to a porosity test. In this test the samples were placed in a dye solution under pressure, after which the depth of penetration was noted. The porcelain was placed in three arbitrary mechanical and porosity grades and a graphical chart made indicating the percentage in each.

MECHANICAL STRENGTH AND POROSITY ARE IMPORTANT

It is evident that the mechanical and porosity characteristics are as important as the electrical. An insulator with high initial electrical strength is of little value if it eventually cracks or becomes conducting owing to porosity.

Combined electrical and mechanical tests are sometimes made. For instance, a suspension insulator is put in tension and voltage is applied simultaneously. After a certain tension is reached the percentage failures increase very rapidly. It is found, however, that the number of failures is not connected with the combined electrical and mechanical tests. It will be found that practically the same percentage of failures occurs whether the voltage is applied simultaneously with the mechanical test or following it. It is also very important that insulators be non-porous.

Puncture.—In making routine electrical tests it is important that they be of such a nature that the insulation is not damaged.

The characteristic voltage-time puncture curve for an actual insulator is shown in Fig. 8. It will be noted

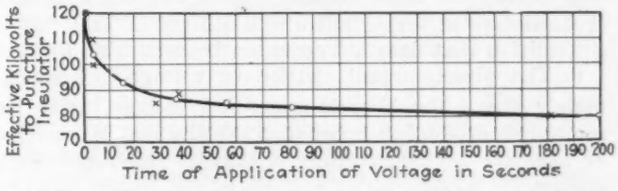

Effective Kilovolts To Puncture Insulator
120
110
100
90
80
70
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Time of Application of Voltage in Seconds

FIG. 8—VOLTAGE-TIME PUNCTURE CURVE OF LINE INSULATORS

that if any voltage above a certain fixed value is applied to the insulator, puncture will occur after some definite time. The application of any voltage above the value that causes failure in infinite time will injure the insulation. The amount of injury will depend upon the voltage and time of application. Long-time high-voltage tests at operating frequency are not logical as there is nothing to be gained from them and they mean a likelihood of serious damage without any external evidence.

The effects of very high lightning voltages are cumulative as may be illustrated by the following test made on 3.2-mm. oiled pressboard:

Kv. Maximum of Impulse Applied	Number to Cause Breakdown
100	∞
140	100
150	16
155	2
165	1

An "infinite" number of lightning strokes at 100 kv. failed to cause puncture. At 150 kv. sixteen strokes were required, yet there was no external indication of failure up to the fifteenth stroke.

Discussion of Electrical Tests.—Various kinds of electrical tests have been suggested or advocated from time to time as a means of detecting porous porcelain or other faults in insulators. No electrical test is known that will anticipate mechanical failure or detect porous material when it is dry. It may be useful, however, to outline the characteristics of the various tests, most of

which are of interest only in the study of design and in developmental work:

1. The 60-cycle test, or test at operating frequency, is the best for general use and is most practical and desirable as a standard test. It can be quite accurately reproduced. It is the most effective in testing either old or new insulators. It will readily puncture porous insulators that have absorbed moisture.

2. Resistance measurements are generally of use only in detecting porous or cracked insulators that have absorbed moisture. On new dry material it indicates little even when measurements are made at 50 kv. or 100 kv.

3. Damped high-frequency tests are often made. Generally a frequency of the order of 100 kilocycles is used. This is obtained from an oscillating circuit giving 120 very highly damped wave trains per second. It acts as a series of impulses. Because of time lag a higher voltage can be applied without spark-over than at 60 cycles. It will not detect old porous insulators that have absorbed moisture. The discharge has a tendency to spread over the insulator surface, and it may thus detect flaws in the petticoats more readily than some other tests. It is not desirable as a standard because it is very difficult to duplicate results. The test is affected by the capacity of the test piece, etc.

4. The impulse test is of use as a design test in determining the impulse ratio, etc.

5. Undamped high-frequency tests will cause failure in insulators at very low voltage because of heat. It is a condition that does not occur on transmission lines.

6. The direct-current spark-over voltage is approximately $\sqrt{2} \times$ the 60-cycle spark-over voltage. It varies somewhat depending upon whether the cap is positive or negative. The puncture voltage is relatively much higher.

7. The 60-cycle test has the desirable characteristics of all the other tests, except that possibly it does not so readily detect flaws in petticoats. This feature is not always important but can be added to the 60-cycle test by making the arc of the insulator part of an oscillatory circuit by limiting the current in the arc by resistance. By this means the oscillatory wave is superposed upon the 60-cycle wave.

In making measurements the sphere gap should be used for oscillatory or transient voltages, the sphere gap, a step-down transformer or a voltmeter coil with a crest voltmeter for 60-cycle voltages. Tests should be made with one side grounded.

The following record of tests on 5-mm. oiled pressboard is an example of the great difference in the effect of various tests on the puncture of insulators:

	Maximum Kv., Application for Sixty Seconds
60 cycles	185
High-frequency alternator, 90,000 cycles	20
Damped oscillations, train frequency (120 per second), 200,000 cycles	120

Ratio of Puncture to Spark-over.—It is now generally conceded that an insulator should be so designed that it will spark-over repeatedly without puncture. The ratio of spark-over to puncture should, therefore, be such that the spark-over voltage will not damage the insulation.

In an early issue of the ELECTRICAL WORLD a continuation of this discussion will appear, covering the characteristics of insulators for very high voltage, the development of factors of safety and insulator selection.

Repair and Inspection of Hydraulic Turbines

When to Take Machines Out of Service—Having Repair Parts and Tools in Readiness for Work—Gaining Access to Different Parts

By L. W. Wyss
Iron Mountain (Mich.) Electric Light & Power Company

THE time to take hydraulic turbines out of service for internal inspections and repairs is governed by the load conditions of the plant or system. If the system is combined steam and hydraulic, the turbine shut-down should be made during a period when no extra coal will be consumed at the steam plant if possible. In order to do this the work may have to be done during low-water periods, or on Sundays and other holidays. If all of the turbines in a station are needed to utilize the total river flow and it is desired to shut down a turbine for a certain period, the plant may be so loaded as to lower the reservoir elevation sufficiently to insure that the surplus will fill the reservoir instead of going over the spillway while the shut-down lasts. This would, of course, not be practicable if the plant were already running with full load or if the extra load to lower the pond could not be obtained. Some plants have no reservoir capacity, while others must maintain a steady flowage for downstream plants. These conditions would prevent using the above-mentioned scheme.

When inspecting turbines it is advisable to learn what repair parts will be needed in the future. Then the work should be planned ahead so that it can be done in as short a time as possible.

In the case of a large turbine being out of service and coal having to be used during the shut-down, every possible scheme for cutting down the period of outage should be employed. If the work is new to the crew employed, some advance instructions are advisable. The power-house crane should be in first-class condition and a signal system decided on. Sets of steel-rope slings should be in readiness to facilitate the dismantling and assembling of heavy machinery. The repair man can copy the erector who avoids the clamping and unclamping of his hoisting cables and instead has a few slings which he can attach through eye-bolts, etc., using a bolt to hold cable. Some spare nuts and bolts are convenient to have on hand in case any are lost or damaged. It may be necessary to make some special wrenches to speed up the work, and it is advisable to have all of the tools ready. Setscrews and bolt threads which are to be submerged should always be covered with red or white lead when assembling.

In order to make repairs, especially with vertical units, it is often necessary to dismantle the generator; but at a few plants of the latest design the large vertical single runners may be taken out through the draft chamber if need be. It may be necessary to drain the draft tubes for certain work, in which case slots can be provided for stop logs to keep the tailwater out and pumps used to empty the draft tube. Holes may be drilled in turbine penstocks which will allow cables to pass through and permit using the crane to handle machinery inside. These holes can later be tapped and plugged.

As the latest turbines seldom have more than two runners and since exposed gate mechanisms are gaining

prestige, interior inspection of them is much simpler than that of turbines with as many as eight runners and all gate mechanism submerged—a typical form of installation a few years ago. Runners should be inspected to see that there are no blocks of wood lodged in between the vanes and that the vanes are not cracked or corroded excessively. Corrosion is usually observed on the backs of the runner vanes where voids are formed at part-gate opening. Grease plugs are provided on some turbines so that grease can be inserted by hand or with a grease gun to lubricate the gate machinery. All of the wicket gates should be inspected to see that they open and close properly and that there is no excessive wear in the links or gate-shaft connections. Such wear may prevent the gates from opening wide, cutting down the waterwheel output, or from closing tight so that it is difficult to stop the unit. Besides, water is wasted during shut-down.

The lignum vitæ used for submerged turbine bearings should be examined to see that it is not rough and that the shaft is not cut or worn. The bearings should also be set in their proper positions so that they will carry their proportionate parts of the weight of a horizontal shaft, and in case the shaft is vertical they should be set so that they hold the shaft in proper alignment.

Erecting engineers use levels or similar instruments to align shafts, but it is exceedingly difficult to obtain an accurate level reading on a corroded or pitted shaft that has been in service a year or more. This difficulty may be overcome by inserting a thickness gage at different points around the circumference of the runner at the stationary speed ring (also called running joint) where there may be clearances of about $\frac{1}{32}$ in. (0.8 mm.).

These points can be reached when the wicket gates are wide open. Provided the speed ring is not worn, it will serve as a guide to determine the shaft alignment. When adjusting the jackscrews care must be exercised to draw all screws on each side of the bearing to the same tension, otherwise the lignum-vitæ block will not line up with the shaft and will wear rapidly.

Double-runner horizontal units often have a center bearing inside the draft chamber accessible through a sealed manhole. This bearing can be adjusted to carry its proportional part of the weight after the end bearings are set correctly. These center bearings may be rather difficult to inspect or replace and some sort of scaffold must be arranged for the work. Removing the lower part of the bearing housing gives access to the lignum-vitæ block. The center bearings, with which the writer has had experience, have had this housing held in place with about six vertical machine screws. To lower the housing two of the setscrews were removed and threaded bolts were screwed in their place. Nuts were then screwed up on these bolts to hold the housing while the remaining screws were removed. The housing could be lowered by turning the nuts down on the bolts.

It is of the utmost importance to prevent the runner, speed ring or seal rings from wearing (owing to the shaft being out of alignment) because leakage of water will ensue, cutting down the efficiency, causing end thrusts and possibly bearing troubles. When seal rings are worn they can be replaced with some degree of convenience; however, large runner or speed rings are very expensive to replace. While inside the turbine it may be a good idea to look over the grease pipes which convey grease to the bearings and also to clean the screens where water is taken for gages, water-cooled bearings, etc.

Where ring-oiled babbitt bearings are employed for horizontal shafts access thereto is usually provided by some sort of steel or concrete inspection tunnels. Since the satisfactory performance of a vertical turbine depends upon the degree of generator-bearing perfection, ample attention should be given these parts.

It is often inconvenient to shut the water off from a turbine to repack packing glands on the main shaft, gate shaft or individual wicket-gate shafts, so it should be done while the turbine receives its regular inspection. While square hydraulic packing is usually used, some water-plant men prefer round packing because its elasticity holds the water with relatively little compression compared to square packing. At one plant containing exposed-gate machinery and non-adjustable wicket-gate glands trouble was encountered with water leaking until soft round packing containing a rubber center was used.

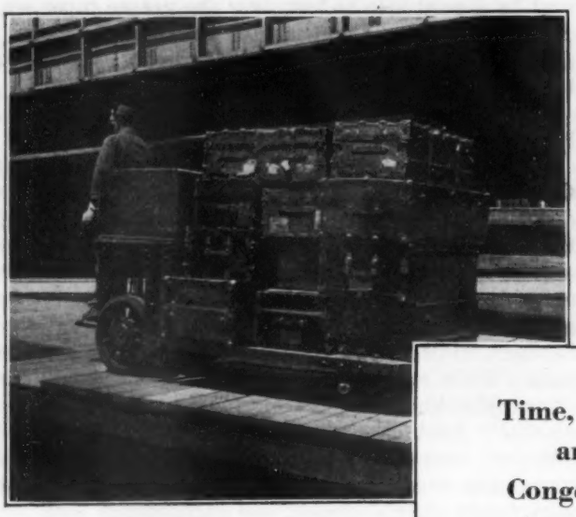
As the shaft is usually damp just outside the packing gland, it corrodes there. For this reason it is advisable to keep the gland as full as possible, because where the packing bears on the shaft it is kept clean. However, if a shaft runs a few months with the stuffing gland drawn up nearly tight and then is repacked, the rough shaft may ruin the new packing unless the rust is polished off.

While most glands are packed to withstand water pressure, some have to prevent air from leaking into the draft chamber. To assure a good vacuum seal water is discharged into a gland through a pipe connected to the penstock. These glands can be packed without shutting the water off from the penstock. Just enough water to keep the packing moist should be allowed to seep through a packing gland. The vicinity of a gland is often an eyesore because the dripping water is not handled properly. Some funnels and piping made to meet the individual requirements are advisable to improve the appearance.

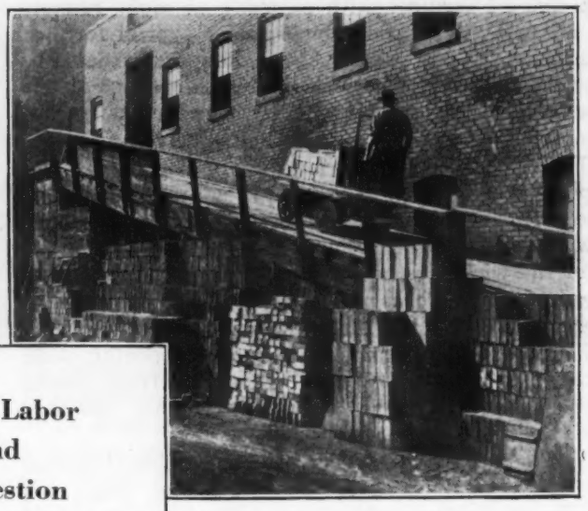
Mercury-Vapor Lamp for Alternating Current

A NEW form of high-voltage alternating-current mercury lamp developed by Henri Georges was described recently in the *Revue Générale de l'Electricité*. In ordinary circumstances it is only possible to run such lamps on an alternating supply by the use of special electrodes. M. Georges, however, overcomes the difficulty by introducing neon gas into the tube, which is of quartz.

The lamp is connected to a 110/3,000-volt transformer and when first switched on exhibits the characteristic spectrum of luminescent neon. This, however, is quickly replaced by the mercury spectrum as the mercury volatilizes, and in seven minutes the lamp attains a steady state. There is then a drop of 125 volts per inch (50 volts per cm.) of tube, and an internal temperature of 1,300 deg. Fahr. (700 deg. C.) is attained. The present lamp takes 1 amp. at 2,250 volts, but it is hoped to construct lamps taking up to 10 kw. and furnishing the most powerful source of ultraviolet energy known.

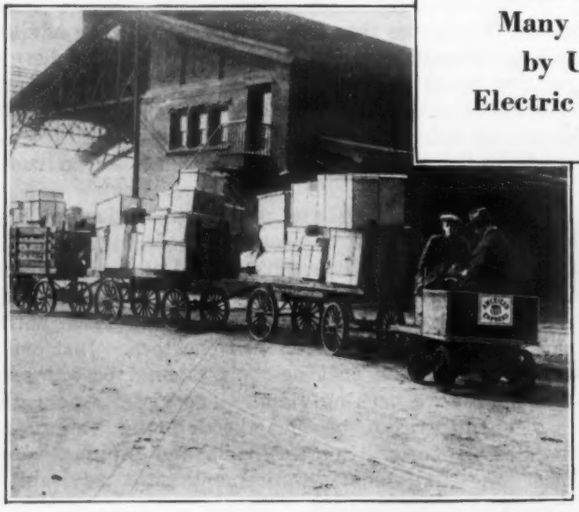


A service where speed and avoidance of congestion are important.

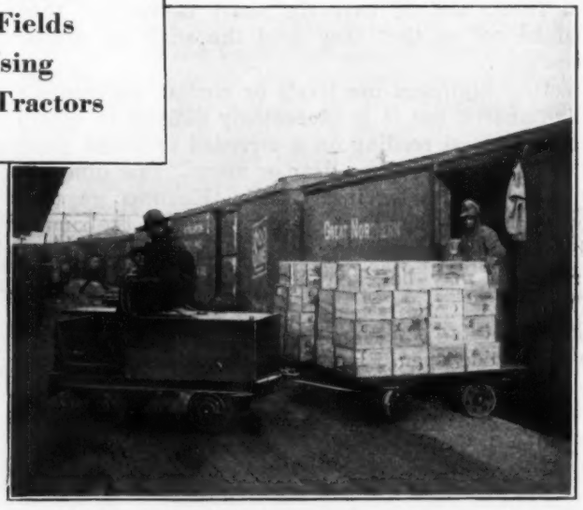


Electric tractors are particularly advantageous on grades.

Time, Labor and Congestion Are Being Saved in Many Fields by Using Electric Tractors



Several trailers, each the equivalent of several hand trucks, being pulled by one tractor.



Avoiding the delays which result from ingress and egress of hand truckers.

Simplicity of electric tractors permits use of any kind of labor

Internal transportation is a large field for electric tractors.

Central-Station Costs and Income

Tendencies that Appear Under Present Conditions—Vigorous Efforts Are Apparent to Increase Plant Efficiency and Render Larger Service in Face of Higher Costs—Larger Revenue Helping to Meet Unusual Requirements

WAR-TIME service problems of New England central stations were reviewed in an extended article in the ELECTRICAL WORLD of May 17, 1919, page 1007, special emphasis being laid upon the plant expansion forced upon the companies by the great conflict, increased costs of operation and enormously enlarged outputs. How well these central stations "did their bit" is established for all time, and what was true of New England applied similarly to other parts of the country. It is now possible to examine typical central-station operations since the war attained its height, and by plotting the operations of a representative group of companies from 1914 to 1920 inclusive to analyze the tendencies of the full period and in so doing draw the inevitable conclusion that the prosperity of the industry, of which these companies are a partial cross-section, demands scientific administration, broad direction and a plane of income far above former levels if the public is to be served properly.

Twelve Massachusetts central stations have been grouped in deriving the combined charts presented, viz., the companies at Brockton, Cambridge, Fall River, Fitchburg, Haverhill, Lawrence, Lowell, Lynn, New Bedford, Salem, Springfield and Worcester. Fig. 1 shows the growth in connected load, generating plant ratings and total customers for the seven years. The twelve plants were more than doubled in capacity, and the increase from year to year paralleled the connected load, although the development of the interconnection idea may be responsible for a perceptible "spread" between the capacity and connected load curves from 1917 forward. With interconnection local loads can be handled with smaller installations, so that the ratio of connected load to plant rating can safely be increased. A better diversity-factor goes with the larger connected load, it is safe to say, and this element, combined with the ability to exchange reserve capacity at convenient times, means a relatively smaller investment for a given volume of business. Only about one-half these companies as yet make extended use of interconnection, so that the benefits would be much more evident were the practice common to all.

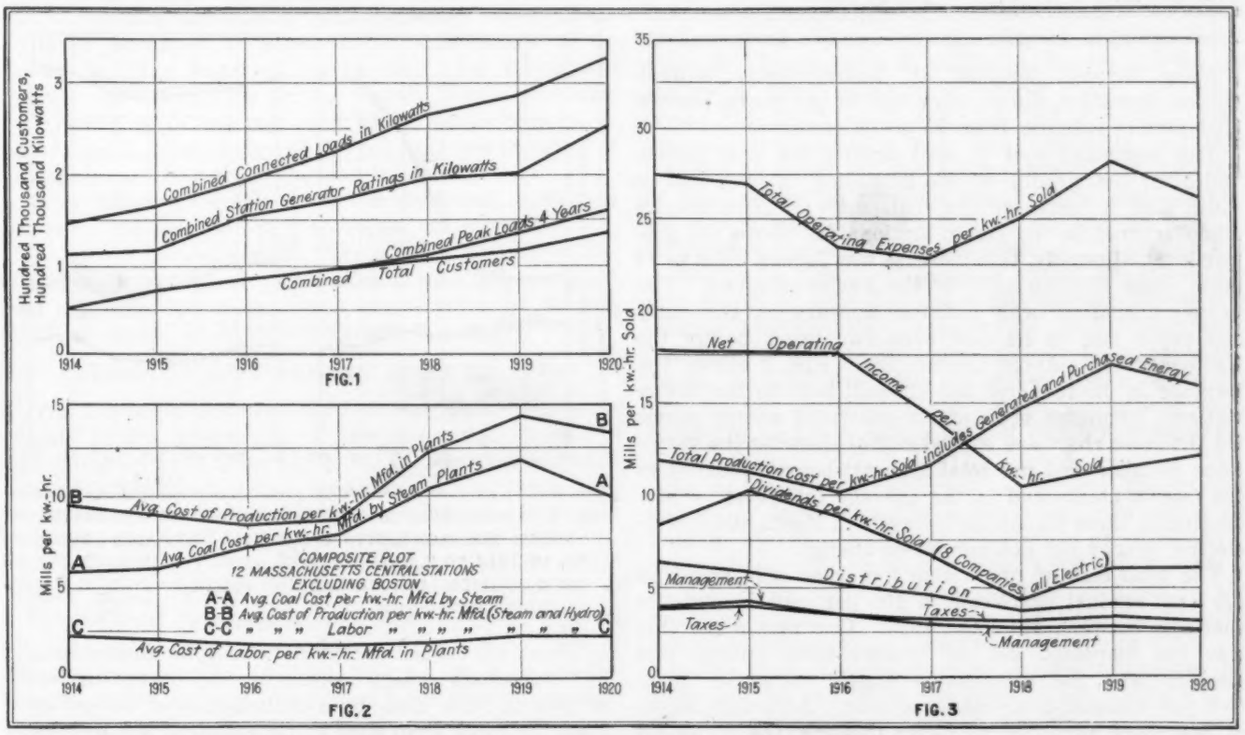

Hundred Thousand Customers, Hundred Thousand Kilowatts
Combined Connected Loads in Kilowatts
Combined Station Generator Ratings in Kilowatts
Combined Peak Loads 4 Years
Combined Total Customers
1914
1915
1916
1917
1918
1919
1920
FIG. 1
Mills per kw.-hr.
Avg. Cost of Production per kw.-hr. Mfd. in Plants
Avg. Cost of Production per kw.-hr. Mfd. by Steam Plants
Avg. Coal Cost per kw.-hr. Mfd. by Steam Plants
COMPOSITE PLOT
12 MASSACHUSETTS CENTRAL STATIONS
EXCLUDING BOSTON
A-A Avg. Coal Cost per kw.-hr. Mfd. by Steam
B-B Avg. Cost of Production per kw.-hr. Mfd. (Steam and Hydro)
C-C " " " Labor " " " " " " "
Avg. Cost of Labor per kw.-hr. Mfd. in Plants
FIG. 2
Mills per kw.-hr. Sold
Total Operating Expenses per kw.-hr. Sold
Net Operating Income per kw.-hr. Sold (includes Generated and Purchased Energy)
Total Production Cost per kw.-hr. Sold
Dividends per kw.-hr. Sold (8 Companies all Electric)
Distribution
Management
Taxes
Taxes
Management
FIG. 3

FIG. 1—AGGREGATE COMBINED GROWTH IN CONNECTED LOAD, GENERATING-PLANT RATINGS AND TOTAL CUSTOMERS OF TWELVE MASSACHUSETTS STATIONS. FIG. 2—AVERAGE COST OF PRODUCING ELECTRICAL ENERGY IN MASSACHUSETTS INCREASED 65 PER CENT FROM 1914 TO 1920. FIG. 3—NET OPERATING INCOME REACHED LOWEST LEVEL IN 1918

The number of customers served by the twelve stations increased to nearly three times the total of 1914, or to about 140,000. So much emphasis has been laid upon the growth of these plants in industrial load that this evidence of a more popularized service is most gratifying. As 1.85 kw. of plant rating is required per customer today, compared with 2.14 kw. per customer in 1914, it appears that care has been taken to make the investment work harder, thus tending to reduce the burden upon the public for a given service.

The increased cost of coal during this period has been the most striking single item of operating expense. Fig. 4 shows that the twelve companies paid nearly $9 per ton for fuel during the last two years, compared with about $4.20 from 1914 to 1916 inclusive. Notwithstanding the difficulty experienced in obtaining coal of high quality during the height of the war, the actual coal consumption per kilowatt-hour produced in the steam plants shows a progressive decrease from slightly

over 3 lb. for the twelve stations averaged in 1914 to about 2.4 lb. in 1920. It is interesting to learn that a decided improvement in the load factors of individual stations has been attained during the past few years, partly as a result of the expansion of output and partly owing to more skillful management of plants. In the year ended June 30, 1920, the following load factors were attained by the several companies, defining the load factor as the ratio of the average load at the station buses for the entire year (including both generated and purchased energy) to the maximum load carried on the system:

	Load Factor per Cent		Load Factor per Cent
Brockton	38.8	Lynn	36.3
Cambridge	36.2	New Bedford	40.2
Fall River	35.9	Salem	39.8
Fitchburg	44.0	Springfield	28.4
Haverhill	28.0	Worcester	30.6
Lawrence	34.5	Boston Edison	41.0
Lowell	38.4		

Many former analyses of Massachusetts central-station operation, dating back five to ten years, showed load factors ranging from 25 to 35 per cent.

The ascending cost of coal during the war period, and after the signing of the armistice, in fact, was so rapid that it increased the coal cost per kilowatt-hour manufactured in the steam stations far above the pre-war level. Roughly, this increase was from 6 mills to 12 mills from 1914 to 1919 in the twelve stations. The value of coal as war material appears in the early and rapid rise in its cost even two years before the United States entered the conflict. Fig. 2 shows the increase in the fuel cost per kilowatt-hour in the twelve stations, computed upon steam-generated energy alone. On the same chart are plotted curves showing the variations in labor cost per total kilowatt-hours produced in the twelve plants and in the average total cost of production in these plants, including both steam and hydro-electric energy but not purchased energy.

The total cost of production increased only about 58 per cent against practically a 100 per cent increase in fuel cost between 1914 and 1919. One reason for this was the increased use of hydro-electric energy and another was the remarkably steady curve of labor cost per kilowatt-hour manufactured. Although wages of operators advanced all along the line, the increased outputs of the plants practically offset these advances, the twelve plants averaging not far from 2 mills per kilowatt-hour manufactured throughout the greater part of the period analyzed. It should also be borne in mind that as the policy of interconnection developed large blocks of energy were interchanged between plants with very little increase in labor requirements.

To compare the operations from the commercial standpoint, data based upon the energy sold are most helpful, and Fig. 3 shows the combined results of the twelve companies averaged per kilowatt-hour delivered to customers. The total operating expenses of the companies decreased from about 2.75 cents in 1914 to about 2.3 cents in 1917, and then rose rapidly to a maximum of about 2.8 cents in 1919. Production costs rose so much that the net operating income per kilowatt-hour fell off sharply from about 1.75 cents in 1914 to 1916 down to about 1.05 cents in 1918. Along with this decline went the dividends per kilowatt-hour sold, which dropped in the eight electric companies of the group (gas combination companies were not plotted as to dividends) from about 1 cent per kilowatt-hour sold to about 0.46 cent. Management expenses, distribution expenses and taxes per kilowatt-hour sold did not change as materially, and owing to increased outputs some good declines in these were obtained. Total taxes, of course, rose substantially during these years.

Before 1917 was far advanced toward its close the need of increased rates became apparent to the managers of central stations, and rising cost of commodities in general accustomed the public to paying more for products and service of all sorts. Rate increases were put into effect in many companies, in the form of coal clauses, percentage increases or surcharges on bills for energy. Fig. 5 shows the average revenues derived per kilowatt-hour sold for commercial lighting, power and total sales of energy in the twelve companies. When the war broke out these companies were selling energy for commercial lighting at an average of about 8.9 cents per kilowatt-hour and power

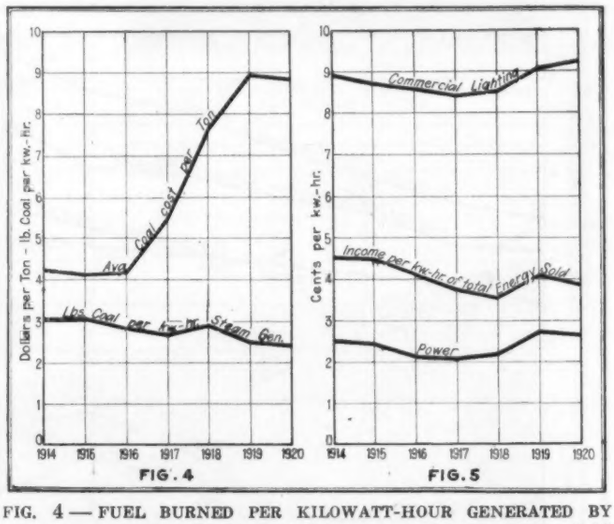

Dollars per Ton - lb. Coal per kw.-hr.
Ave. Coal cost per Ton
Lbs. Coal per kw.-hr. Steam Gen.
1914 1915 1916 1917 1918 1919 1920
Cents per kw.-hr.
Commercial Lighting
Income per kw.-hr. of Total Energy Sold
Power
1914 1915 1916 1917 1918 1919 1920

FIG. 4 FIG. 5

FIG. 4 — FUEL BURNED PER KILOWATT-HOUR GENERATED BY TWELVE MASSACHUSETTS COMPANIES DECREASED FROM 3.05 LB. IN 1914 TO 2.48 LB. IN 1920. FIG. 5 — AVERAGE INCOME FROM COMMERCIAL LIGHTING AND POWER OF TWELVE MASSACHUSETTS COMPANIES

at about 2.5 cents. Increases in output unaccompanied by immediate sharp advances in operating costs, coupled in some cases by a continuation of the policy of lowering rates from time to time as business developed, brought down the average yield per kilowatt-hour to about 8.4 cents for commercial lighting in 1917 and for power to about 2.1 cents. From these low points the rate revisions forced by war prices resulted in higher average returns in following years, but the actual average return per total kilowatt-hours sold did not increase until 1918. This was probably due to the increased sale of energy between companies, which involved the interchange of large blocks at comparatively low rates. At the close of the war the commercial lighting return among these companies was about where it was at the beginning, and the power yield per kilowatt-hour was perhaps a little better. Both lighting and power yields are now on higher planes than the pre-war figures occupied, but rate adjustments upward are still proceeding and the further advance of the net income is becoming appreciated as necessary by both the public and the companies, in order that capital needed for expansion shall flow into the utility field. The evidence of recovery, although slow, afforded by such charts as the foregoing is an encouraging sign to believers in the stability of electric utilities.

Status of Austrian Electrical Industry

Although the Austrian Republic Is Broken Down Politically and Economically, the Industrial Future of the Nation Under Possible Conditions of Electrical Development Has Elements of Promise—Market in Eastern Europe for Austrian Products

By I. SEIDENER and A. GRUENHUT
Editors "Elektrotechnik und Maschinenbau"

WHILE it would be possible to make a very pessimistic sketch of conditions in Austria at present, nevertheless a bright future awaits the electrical industry of that country if it is sufficiently supported. When it is considered that the sales territory of eastern Europe can be reached with smaller freight charges than from the United States, it becomes clear that the starting up of new industries in Austria furnishes a brilliant opportunity for American capital.

There is a deplorable absence of mineral resources, but the country possesses a wealth of water power which could be developed at a reasonable expenditure owing to low building costs and to the fact that wages are much lower than in the United States. For a thorough understanding of the problems which would face interested capital a knowledge of the political and economical situation resulting from the war is essential.

It is easier to divide a nation politically with one stroke of the pen than it is to adjust the economic relations of the divided parts. Agriculture, commerce, industry and transportation formed a tie that nourished and supported the tremendous organization of the old dual monarchy of Austria-Hungary.

Division of the Monarchy After the War

The effects of the war have shown themselves most plainly in the destruction of the monarchy, which fell apart like an arch from which the centerstone had been taken. After the partition by which parts of the empire were assigned to Czechoslovakia, Poland, Rumania, Italy and Jugoslavia, or the so-called national states, the Austrian Republic was reduced to an area of 32,800 square miles (85,000 sq.km.), with a population of 6,500,000. Of this population about one-third lives in the city of Vienna. The old monarchy had an area of 260,000 square miles (673,000 sq.km.), with a population of 50,000,000. In other words, the present republic is one-eighth the size of the fallen empire.

Like all industries of the old empire, the electrical industry has been influenced by the tremendous changes of late years. Large concerns in Vienna have been separated from their branches and installation bureaus in the national states. These territories of trade have not only been separated politically but also cut off economically through the establishment of export and import regulations. As a result of these restrictions and difficult formalities the economical condition of all concerned has been reduced to a state recalling the Middle Ages. The reduction of freight and passenger transportation and the decreased efficiency of telegraph and telephone service are also contributing factors to the chaotic situation.

Not only have the selling organizations been disarranged through the separation of the different states but production also has felt its influence deeply. It is true that the change of the industry from a war to a peace basis was accomplished without delay through the efficiency and ability of manufacturers and employees, but the new policy of separation worked more hardship than the war blockade. The electrical industry formerly obtained coal, coke and lubricating oils from Poland, coal, coke, pig iron, steel castings, forgings, paper linen and cotton thread as cable materials, insulation for pipe covering, glass and porcelain for insulators, apparatus and lighting fixtures and chemicals for the different processes from Bohemia.

The local steel and rolling mills cannot produce cast-iron and steel shapes for dynamos and transformers without coal and coke, which is found in German Austria in small quantities. There is therefore a scarcity of raw materials which could formerly be obtained in any quantity. Particularly depressing is the scarcity of coal, and as a large majority of power plants are steam driven, the result is a drastic reduction in output. Many factories now produce their own electricity, but these also are no better off, since they have to buy American or English coal at fabulous prices. The basis of price calculation has therefore had to be revised with the rising prices of materials and wages.

The impossibility of keeping prices at a level for any length of time has prevented manufacturers from making any definite arrangements or working systematically. Wages increased almost from month to month, keeping step with the cost of living, while falling foreign exchange caused foreign products to increase to as much as a hundred times the peace-time price.

In a factory for electrical apparatus the monthly wages for female employees increased from the end of 1918 to March, 1920, from 400 kr.* to about 1,300 kr., those of the male employees from 1,000 kr. to 3,000 kr. In one of the large factories making all kinds of electrical apparatus average wages per hour for first-class workmen increased in 1918 from 5.70 kr. to 11 kr., for laborers from 4.30 kr. to 9.80 kr., for temporary help from 2.80 kr. to 7.20 kr., for boys from 2 kr. to 4.50 kr., and for women from 2 kr. to 4.50 kr.

Production has decreased 25 per cent, and many social changes have made themselves evident in different ways. Contact with the working force has become easier, but a general lack of energy can be observed, not only in the workers as a group, through shortening of the working day, frequent strikes and demonstrations, but also individually, in spite of all wage increases. The cost of living has gone up to such an extent that even the most economical and level-headed workman is undernourished, and he may besides be suffering physically in other ways as a result of the war.

Selling on credit or checks has stopped completely. The rule is no longer cash on delivery of the goods but when the order is placed. Months pass between the placing of the order and its execution, and therefore much capital is required to keep business going. Price offers are no longer binding, for the seller sets the price on the day of delivery. Certain groups of manufac-

*The exchange rate on the Austrian crown before the war was 20.26 cents. Late quotations range from .255 to .335 cent.

turers have, however, protected themselves in a measure by mutually agreeing upon and announcing a monthly increase in prices. Most producers determine this individually, as they please, and without any effective opposition. The buyer is compelled to submit, no matter how high the price has gone up by the time the goods are delivered—even if delivery is delayed for a great length of time through local ordinances, transportation difficulties or import or export regulations.

Outlook More Hopeful at the Present Time

Although the prevailing conditions have not been sketched too severely, it must be admitted by those familiar with them that a little light is beginning to show which warrants hope for the future. The increased capitalization of all industries is not the result of the decrease in value and the scarcity of money, but is partly a preparation for work when more normal times arrive. If there are prospects for the development of any industry, the electrical industry is surely the one. The wealth of the country is formed by its water power, and the utilization of this power has become urgent because of the lack of the coal and crude oil which could be obtained formerly in any desired quantity. The contemplated electrification of the railroads will furnish employment and orders for the different industries for years to come, even if foreign capital insists on participation of its own industries in the execution of the orders. It is true that this would not be sufficient to keep the plants running regularly. This would only be the case if all the other industries could start up at the same time.

ECONOMIC TIES WHICH HAVE BOUND THE AUSTRIAN ELECTRICAL INDUSTRY WITH THE SECTIONS OF THE DIVIDED MONARCHY ARE SHOWN IN THIS TABLE

Factories for the production of	Number of Workmen		Value in Millions of Kronen			Sales, in Millions of Kronen				Work Produced by Workmen in Percentage of the Peace Production	Connections with the National States		
	Now	Normally	Buildings	Products	Capacity Hp.	Austria	National States	Hungary	Foreign Countries		Expedition Branches	Offices	Warehouses
Electrical machines and apparatus—transformers, meters, etc	1,000	12,000	40	130	3,500	42	66	12	10	60–70	10	100	15
Telegraph apparatus, telephones, signal installations, railroad-safety devices	4,000	6,000	15	30–40	1,000	10–14	17–22	3–4	..	60–70	2	...	..
Electric lamps	3,000	5,000	8	10	1,200	3.5	1	0.5	5	60–70	...	...	...
Cables	2,500	2,800	25	58	1,500	11.5	35	3.5	8	50–70	50	15–20	60

Great Need for Raw Materials

Austria cannot exist without an assured supply of coal and raw materials. As soon as this question is solved normal conditions will prevail again which will lead to renewed activity and prosperity for the electrical industry. It will be able to develop with the erection of light and power installations in houses and factories, in city and country, the enlarging of old installations and the work of supplying local demands as well as those for export. As far as the last are concerned, the balance of business in peace times was always passive since imports and exports were practically equal. The needs of the country were so large that the newly developed industries could only partly fill the demand. For instance, the imports in 1910 amounted to 27,299,000 kr., while in 1913 they were 38,809,000 kr.; the exports in 1910 amounted to 9,756,872 kr. and in 1913 to 12,129,355 kr.

Austria-Hungary could always export certain special articles, especially electric lamps, which found a market in many European and oversea countries. The electric lamp exports, for instance, reached in 1912 the value of 6,500,000 kr., and in the same year 655,000 kr. worth of lamps were imported. This can be explained by the demand for special foreign products by the branches of foreign concerns. It would seem reasonable to suppose that exports have been completely crippled by the constantly increasing transportation difficulties. Just the contrary, however, is the case. The export of electrical merchandise has grown considerably. In the second half of 1919 more goods were exported by the German-Austrian concerns alone than the total quantity for the entire monarchy in the best years of peace. The imports of the country dropped very sharply, which shows the difficulties experienced by the trade in supplying the market, since the present trade policy, instead of assisting all industrial forces in their development, is based on the supposition that exclusion of foreign trade must be helpful to the home industries.

Although the growth of exports can be traced largely to the low foreign exchange quotations, it has also been due to the excellence of Austrian electrical products having become known in other countries. A large part of the newly acquired customers will undoubtedly continue ordering these products.

Electrotechnical Society in Vienna Is Aiding in Industrial Development

The members of all branches of the electrotechnical industry of Austria are united in the "Electrotechnical Society of Vienna," founded in the memorial year 1883 of the international electrical exhibition in Vienna. This society has acquired a large membership under the guidance of the most prominent men in the electrical industry and can look back on a period of thirty-seven years of far-reaching and successful work. Prof. Carl Schlenk is president of the society at the present time. The society publishes its own paper, *Elektrotechnik und Maschinenbau*, which enjoys an international reputation as a valuable trade journal.

In a succeeding article the power possibilities of Austria, together with the status of the central station industry, will be discussed.

"UNFAIR *methods" include all those practices which, while not illegal, are economically and industrially wasteful, because such success and profit as they produce is gained at the expense of the public, instead of by reduction of costs or improvement of quality and methods. . . . Unfair methods; such as accepting rebates, local underselling at a deliberate loss, bogus competition, running down a competitor's goods, bribing his salesmen, false litigation, etc., may or may not be unchristian, but they are bad because they are economically unsound, tend to inefficiency, corrupt monopoly, high costs and high prices.*—PHILIP CABOT.

Hold-Down Magnet Control for Vertical Plate Shears

Standardization in Design of Adjustable Pulpit for Control of Hold-Down Magnets Thought Desirable—Arrangement of Treadle Switches

BY S. L. GUTHORN
Electrical Engineer, Perin & Marshall, New York

IF THERE is coming to be an extensive use of electromagnets for holding plate at vertical shears, it seems that some standardization should be attempted. With that standardization in view a number of equipments have been laid out with features adaptable to all shears of this class. Each equipment consists of from one to four hold-down magnets, the number depending upon the size of the plate, mounted within the lower knife-holder casting, two treadle switches and one push-button station at the shear, and a contactor panel remotely placed. The push-button is hand-operated; one treadle switch is foot-operated and the other shear-operated. The operation is briefly as follows:

When a plate has been set at the shear the operator presses the foot switch, energizing the hold-down magnets which hold the plate. It is not necessary to retain the foot switch in the reverse (closed) position, for the contactor circuit, once made, is maintained through, and current reduced by, the holding resistance on panel. The operator then brings down the upper shear blade, cutting the plate. At the bottom of the shear stroke a push rod connected to the upper shear blade operates the treadle switch, opening the circuit through the hold-down magnets. The hold-down magnets then retain only their residual magnetism.

As the shear blade returns to normal it releases the shear blade switch for the next cycle. In order to demagnetize the hold-down magnets and release the plate, the push-button is now touched and a small demagnetizing current is established to counteract the residual magnetism. This frees the plate, permitting its being passed on. Should it be decided that a plate held by the magnets owing to the initial operation of the foot switch is not to be cut, then the normal interruption of the magnetizing current by the shear-blade switch is performed by the push-button.

Fig. 1 shows the control equipment arranged on a pulpit, also the hold-down magnets, push rod and shear, while Fig. 2 shows enlarged views of the complete pulpit proper. It consists of frames *A* and *B*, made as shown, and of 1½-in. x 2-in. (3.8-cm. x 5.1 cm.) angles. They are bolted together by four ⅜-in. (1.6-cm.) cross-rods. Each frame carries a treadle switch and counterweighted foot lever—frame *A* that for shear operation, and frame *B* the foot switch. Frame *B* is

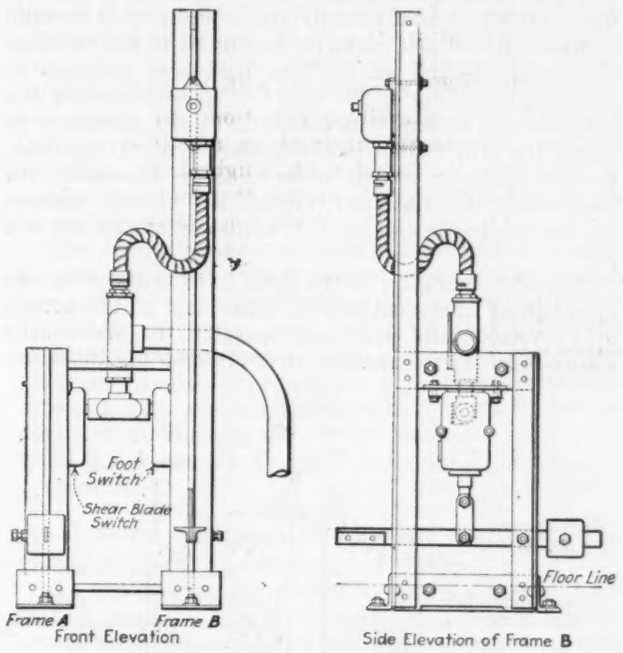


FIG. 2—METHOD OF MOUNTING SHEAR AND TREADLE OPERATED SWITCHES

extended to carry the demagnetizing push-button station. It also permits adding the master control of such an auxiliary as the scrap-handling apparatus. By means of the ⅜-in. (9-mm.) spacers in frame *B*, the push-button station is adjustable to the height desired by the operator. The flexible-conduit connection allows this adjustment to be made with ease. Frames *A* and *B* may be interchanged or their centers adjusted by means of the four cross-rods.

The circuits, in sequence, resulting from the above cycle are as follows: Referring to Fig. 3, when a plate has been set at the shear, the operator presses foot switch, closing its contacts and taking current from the plus side of the line *L*-2 through terminal *B*, to operating coil of magnetizing contactor through terminal *F*,

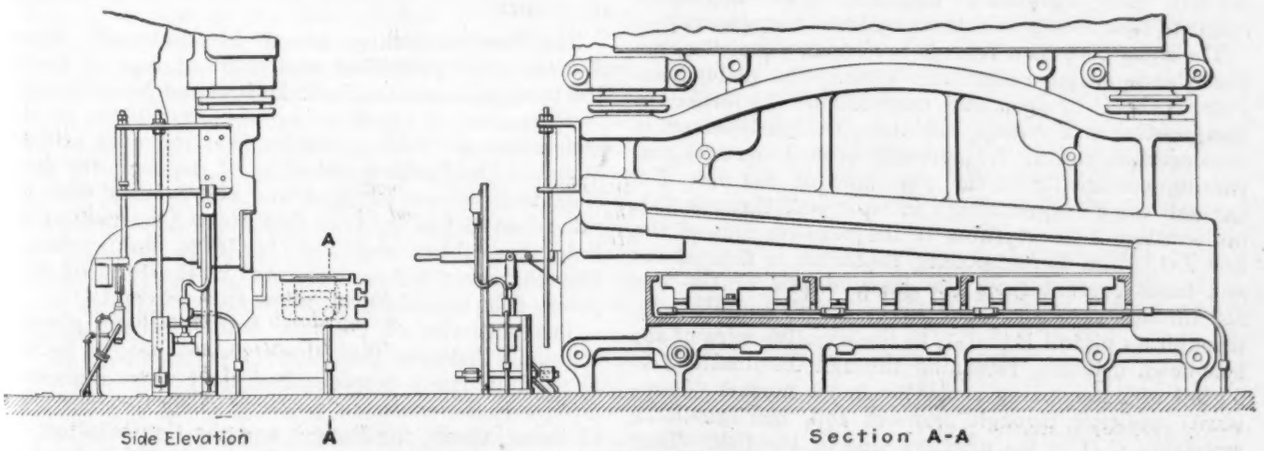


FIG. 1—ARRANGEMENT OF CONTROL EQUIPMENT ON PULPIT OF PLATE SHEAR

thence to terminal *S*-2 through the foot switch, the normally closed contacts of the shear-blade switch, through the normally closed contacts of the push-button switch, back to terminal *S*-1; thence to terminal *R*-2 to the negative side of the line at blow-out coil terminal and *L*-1. The magnetizing contactor, thus energized, closes upward, taking current directly from the line *L*-2 through its blow-out coil and contacts, its pigtail to the terminal *T*-2, thence to the set of three hold-down magnets in multiple, returning to *T*-1 and *L*-1, thus energizing the magnets and holding the plate. It is not necessary to retain the foot switch in the reverse (closed) position, for the contactor circuit, once made by depressing the foot switch, is maintained through, and current reduced by, the holding resistance *F*-*E* across terminals *S*-2 and *S*-3.

The next operation in the cycle is to bring down the upper shear blade, cutting the plate, and at the bottom of the stroke the push rod operates the shear-blade switch, opening its contacts, thus interrupting the main-

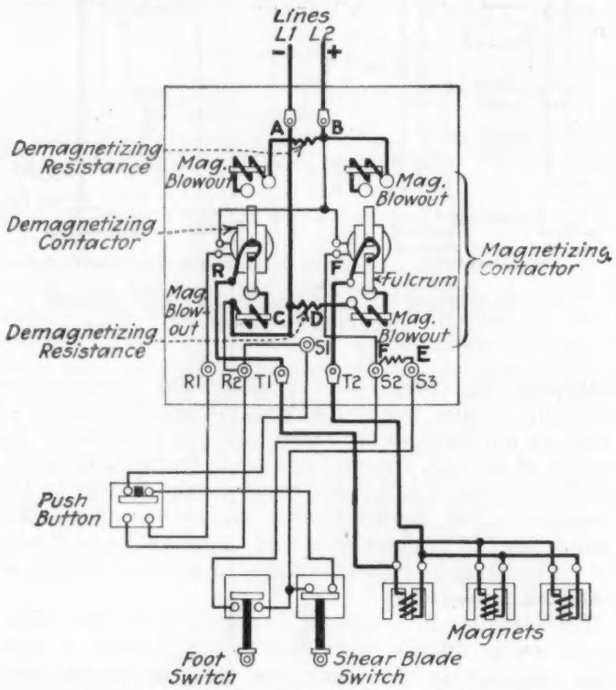


FIG. 3—WIRING DIAGRAM FOR SHEAR-CONTROL CIRCUITS

contactor holding circuit, which opens the circuit through the hold-down magnets. The hold-down magnets then retain only their residual magnetism.

The shear blade now returns to normal, permitting the shear-blade switch contacts to close. The plate, however is held by residual magnetism. In order to demagnetize and release the plate, the push-button is now pressed, closing its normally opened contacts and passing current from the plus side of the line *L*-2 through the demagnetizing contactor coil, through R-1, push-button, *R*-2, returning to the negative side of the line *L*-1. The demagnetizing contactor is thus closed and takes current from the positive side of the line *L*-2 through resistance *A*-*B*, blow-out coil and contacts, through its pigtail *R* to *T*-1, to the negative wire of the hold-down magnets, returning through terminal *T*-2 to pigtail of magnetizing contactor in its normal (downward) position through blow-out coil, demagnetizing resistance *C*-*D* to the negative side of the line. Thus a small demagnetizing current is maintained to counteract the residual magnetism during the period that the demagnetizing push-button is depressed. This frees the plate, and it passes on.

Should a plate come up to the shear and be held by the magnets owing to the initial operation of the foot switch, and should it be decided not to cut the plate, then the normal interruption of the magnetizing current by the shear blade switch as above described is performed by the push-button, for in depressing the latter it first interrupts the magnetizing current, since its normal contacts are in series with those of the shear-blade switch, while the continuation of the pressing of the push-button performs the demagnetizing function above described.

The induced current, or reactive kick of the magnets caused by interrupting the magnetizing current, is discharged through the circuit formed of magnets *T*-2, normal or lower magnetizing contactor terminal, blow-out coil, discharge resistance *CD* through demagnetized contactor, blow-out coil and pigtail to *T*-1, returning to magnets.

This arrangement of control equipment was first worked up for the Tala Iron & Steel Company, Sokchi, India, as a standard design.

Power of New Battle Cruisers Comparable to Largest Central Station

BATTLE cruisers designed for a speed of 35 knots an hour with a shaft horsepower of 180,000 or 160,000 kva. have placed the power requirements for this class of work on a par with the largest central station. For example, the Northwest station of the Commonwealth Edison Company, Chicago, is rated at 165,000 kw. and the Fisk Street station at 230,000 kw. The Fifty-ninth Street station of the Interborough Rapid Transit Company, New York, is rated at 195,000 kw.

The present naval program calls for the following new classes of battleships and battle cruisers, which are compared with the Tennessee, the latest capital ship to be placed in commission:

	Tennessee	New Battleships	New Battle Cruisers
Length over all, feet	624	684	874
Beam, feet	97	105	90
Draught, feet	31	33	31
Displacement, tons	33,000	43,200	43,500
Speed, knots	21	23	35
Main battery	12 14-in. guns	12 16-in. guns	8 16-in. guns
Shaft, horsepower	30,000	60,000	180,000

The new battleships are to be electrically driven, and the main propelling equipment of four of them—the Indiana, Montana, South Dakota and North Carolina—will consist of two Westinghouse 28,000-kva. turbine-generators and four 15,000-hp. Westinghouse propeller motors. The turbines are to be of the complete expansion, impulse-reaction type and will develop their full rated load at 265 lb. (120 kg.) steam pressure, 50 deg. Fahr. superheat and 28½ in. (124 mm.) vacuum. Electric power will be generated in the form of three-phase, 60-cycle, 5,000-volt alternating current.

The statistics of the new battle cruisers given in the table indicate that these vessels are to be very unusual in many respects, but their most remarkable feature is the enormous power of their turbines. Two of these vessels, the Ranger and the Constellation, will have four main turbines to develop 49,750 b.-hp. each.

Readers' Views and Comments

Centralized Stream-Flow Records Would Be Helpful

To the Editor of the ELECTRICAL WORLD:

SIR: In many engineering investigations pertaining to water power, water supply, etc., it becomes of great value to have as large a number of rainfall and stream-flow records as possible. Still, there are a large number of rainfall stations maintained by various private and public interests which are not reported to the Weather Bureau. For this reason it has been the idea of the writer for some time that the publication of all available rainfall data as well as stream-flow data in a single bulletin or other publication would be of very great value. Having this in mind, a letter was written to Prof. Wilford M. Wilson of Cornell University and the head of the United States Weather Bureau in New York State, asking if the bureau would be willing to publish records if they are obtainable. A reply has been received stating that the bureau will receive, publish and file all records of rainfall made under proper supervision in the state. The records must be reported on blanks furnished by the bureau and can be mailed in franked envelopes.

The various interests which maintain rainfall stations could well afford to turn in reports each month to their section director and have them published. They would thereby be conferring a great benefit on others who might have use for rainfall data and in addition to that would be making the climatological data of more use to themselves, as all the obtainable information for the state would be included in the one publication.

The same thing applies also to the matter of stream-flow records. The subject of stream flow is now so well understood that there is no advantage in holding any particular information under cover, as it is a matter of no great difficulty to compute the approximate flow of a given stream by comparison with others. It would, however, be of the greatest advantage to have every possible record of flow published by some central authorized agency as a matter of comparison with other records. In this way discrepancies between various records of flow on the same stream or river system might be checked up and many errors eliminated.

It is suggested that such additional records of flow might be published either by the State Engineer or the Conservation Commission, or both, in their annual reports and that suitable arrangements be made between the various parties maintaining such stations and one or the other of these authorities for the keeping and publishing of such records. It seems that there might be from two to three times as many records of flow brought together under the covers of one book as are now obtainable from the publications of these two departments.

As an extension of this idea I would suggest that it might be that the American Society of Civil Engineers could well collect and collate the various stream-flow and rainfall records obtainable for past years and publish them in some form so that they would be available to those who desired them. At the present time stream-flow records are scattered in many places, and it is extremely difficult to secure records extending back for any great period of time unless one has been fortunate enough to come into possession of records which are now out of print. It is suggested that this collection of records might take the form of a loose-leaf book of standard letter size, 8½ in. x 11 in., or of small bulletins covering a given stream or stream-flow station which could be punched and inserted in a standard loose-leaf cover. The same system could be applied to rainfall records. This would make an extremely valuable collection which would undoubtedly be availed of by a large number of engineers and interests having use for such records.

The making of these records in loose-leaf or bulletin form would permit the insertion from time to time of any records which might come to light or be offered for publication subsequent to the original publication of such a comprehensive record. It would also enable interested parties to obtain the particular information in which they are interested without going to the expense of purchasing the entire collection.

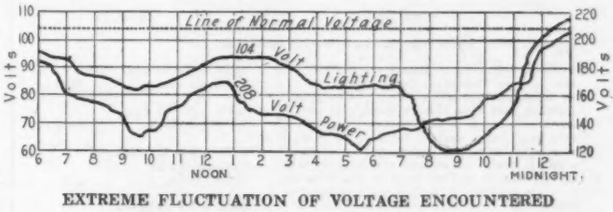
Utica Gas & Electric Co., BYRON E. WHITE,
Utica, N. Y. Engineer.

South American Operating Conditions

To the Editor of the ELECTRICAL WORLD:

SIR: It may be of interest to manufacturers in the United States, especially to those engaged in the export of electrical machinery to South American countries, to know some of the conditions encountered in these countries in the operation of electrical machinery and apparatus.

One of the most common hindrances to be found is the poor voltage regulation. Here in Lima the insufficient generating capacity, the obsolete condition of the distribution circuits and the absence of voltage regulators have brought about intense voltage variations which seem almost incredible. A voltage chart plotted from readings of two circuits, one industrial power and the other lighting, both fed from the same high-tension circuit, is shown herewith.



EXTREME FLUCTUATION OF VOLTAGE ENCOUNTERED IN SOME SOUTH AMERICAN CITIES

Among the immediate results of this state of things are lack of power in the motors and low power factor with consequent heating. It should be borne in mind that when the voltage falls considerably the power becomes very low as it varies with the square of the voltage. For instance, a 5-hp., 220-volt motor when operated at the lowest point of the voltage curve can give only about 1.5 hp., and the speed is also very low.

While it cannot be affirmed that the voltage conditions in all South America are so bad as they are in Lima, neither can it be said that in other places they are much better, as in these countries much remains to be done in regard to the establishment of modern electric service standards.

VÍCTOR M. ARANA,
Lima, Peru. Consulting Electrical Engineer.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

System for Keeping Primary Line Records Up to Date

COMPLETE data covering the primary circuits of the East St. Louis (Ill.) Light & Power Company are given in several 8½-in. x 11-in. (21.6-cm. x 28-cm.) loose-leaf books which are distributed to the various departments interested every month. Every month the data are brought up to date, the maps being revised by a simple method described later.

At the front of each book is an index which shows, under the location number, the make, location and size of all transformer installations. Following this index are the circuit records. Each circuit is arranged as simply as possible on a map showing the section of the city covered by the circuit, but the detailed data are written on a separate sheet rather than on the map, as may be seen by the illustration. The description of each individual circuit begins with a statement of whether it is single-phase or three-phase, the number and size of wire and the routing of the line. In the next column are given the location number, the number and size of transformers and their street location. At the right of the sheet the distance of the transformers from the station is given in feet.

The key copy of the circuit data book is kept up to date by daily pencil notations from work orders. The copies in the hands of the new-business department, service department, load dispatcher's office, etc., are corrected monthly by new revision sheets issued from the construction office.

D. Power Circuit — Sheet #1

T.B.W.P. Solid Copper Wire Unless Otherwise Specified.

3-phase, 3-#4/0 wires from Station 3 to west side of Winstanley Yards, north to State, west on south side State to 19th, north on east side 19th to Baugh, west on south side Baugh to 9th, thence to north side Baugh, then west to 7th St., south on east side 7th to St. Clair, west on north side St. Clair to 1st pole west of 1st, then across barn to trolley poles in Stock Yards, thru Stock Yards to Swift & Co. transformer house.	D-427 - 2 - 25 Kva. 926 Baugh ave.	7100
	D-474 - 2 - 25 Kva. 225 St. Clair Av.	11500
	D-419 - 3 - 300 Kva. Morris & Co. in trans. house.	
	D-420 - 3 - 175 Kva. Swift & Co. in brick Transformer house.	13600
3-phase branch, 3-#6 wires from Baugh south on east side 16th to St. Clair, west on north side St. Clair to 2nd pole west of Wabash and deadended.		5500
3-phase branch, 3#6 wires from St. Clair, south on east side Collinsville to NE corner Pennsylvania.	D-417 - 3 - 20 Kva 700 Collinsville	9600
3-phase brance , 3-#4 wires from St. Clair south on east side Vandalia R.R. tracks to Tank of Purina Mills.	D-454 - 3 - 125 Kva. Ralston Purina Milling Co.	13150

FIG. 1—CIRCUIT DESCRIPTION, KEPT IN LOOSE-LEAF BOOK

This 8½-in. x 11-in. typewritten sheet describes a 2,300-volt power circuit and all its branches as shown on blueprint map of the same size (see Fig. 2). Triple-braid, weatherproof, solid-copper wire is used unless otherwise specified. The first number in the second column, as, for instance, D-427, is the transformer location number. The next figure represents the number of transformers, and the next number the rating. Underneath is the street address. The distance from the station is shown in feet to the right. All transformers are connected in delta or open delta as the case may be.

For the purpose of revising the map, a zinc plate of a map of suitable scale, covering the entire city, was obtained, and from this zinc a stock of maps were printed on onion-skin paper. The circuit is drawn in on one of these onion-skin maps, a border and title are added, and the rest of the map is cut away. This is a very inexpensive way of obtaining a complete tracing from which blueprints can be made at very little expense.

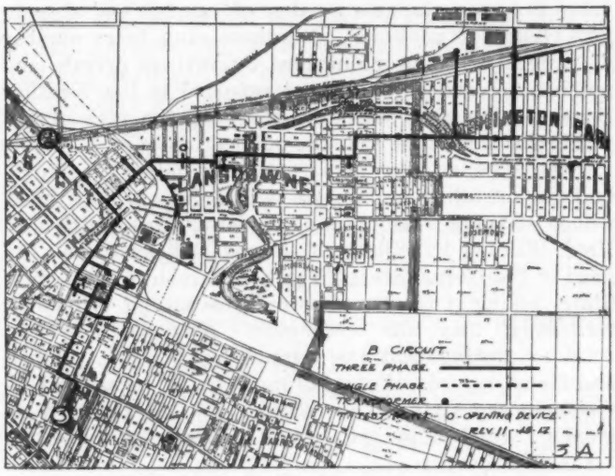


FIG. 2—MAP OF PRIMARY DISTRIBUTION CIRCUIT, WHICH IS REVISED EVERY MONTH

This is a section cut out of an onion-skin map of the entire city. After the circuit is drawn in and the legend is written, this is used as a tracing from which blueprints are made for the different data books.

This method of keeping up the primary line records has been in use for a number of years with practically no change from the original plan, which has worked out very satisfactorily for all concerned.

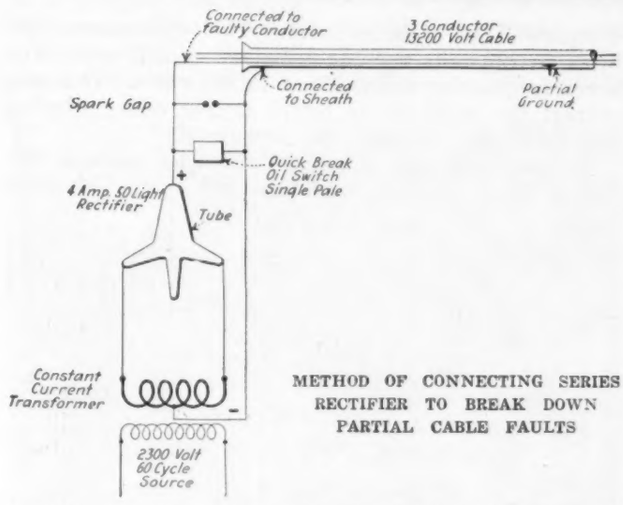
JOHN H. MITCHELL.
East St. Louis Light & Power Company,
East St. Louis, Ill.

Constant-Current Rectifier Locates Cable Faults

A PARTIAL ground or short circuit on an underground cable may be further broken down by means of a mercury-arc rectifier so that a low-resistance ground or short circuit is established which can be readily located with a telefault. A 4-amp. fifty-lamp (about 3,500-volt) rectifier has been successfully used for this purpose in St. Louis on 13,200-volt paper-insulated cable. The rectifier is started up on short circuit through a small quick-break oil switch connected across the direct-current leads which connect the rectifier with the defective cable. The opening of the switch causes a rapid rise in the direct-current voltage,

which finds the weak spot in the cable and establishes a more complete fault. To protect the cable insulation against excessive voltage from the rectifier a spark gap is connected across the direct-current leads. The gap is set at 18,000 volts. The current is not sufficient to damage the cable seriously because the direct current is limited by the rectifier transformer to about 6 amp.

This breaking down could be accomplished by connecting the cable to a live power line, but this often results in damage to the cable and other equipment.


Connected to faulty Conductor
3 Conductor 13200 Volt Cable
Spark Gap
Connected to Sheath
Partial Ground
Quick Break Oil Switch Single Pole
4 Amp. 50 Light Rectifier Tube
Constant Current Transformer
2300 Volt 60 Cycle Source

METHOD OF CONNECTING SERIES RECTIFIER TO BREAK DOWN PARTIAL CABLE FAULTS

WALTER H. MILLAN,
Superintendent of Substations.
Union Electric Light & Power Company,
St. Louis, Mo.

Operating Small Hydro Plants Without an Attendant

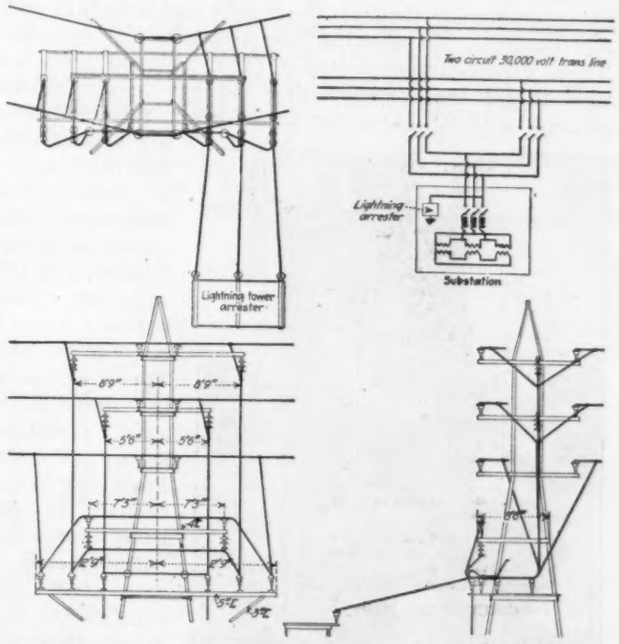
UTILIZATION of small water-power plants that are not physically worn out but whose output does not warrant the expense of an operator is accomplished by the Consumers' Power Company by means of some home-made devices for automatically closing the waterwheel gates. In Battle Creek the old hydraulic station was equipped with a 150-kw., 2,300-volt synchronous generator belted to a 254-hp., 74-in. (188-cm.) horizontal waterwheel. The gate-operating mechanism has been supplied with a drum around which is wound a cable which passes up over a pulley and suspends at its other end a weight which is heavy enough to close the gates when released. On starting the machine the gates are set to take whatever water is available. Connected to the waterwheel by a belt is a small fly-ball governor mechanically connected by a light cable to a trigger that normally locks the cable drum on the gate-operating mechanism. Any undue increase in the speed of the wheel causes the governor to trip the cable-drum trigger, and the weight shuts the machine down by closing the waterwheel gates.

At the west side plant in Grand Rapids no existing machines were available, as the old waterwheel equipment was past the point of satisfactory repair. Two 200-hp. induction motors were installed and belt-connected to two 205-hp., 59-in. (150-cm.) open-flume wheels. Automatic oil switches and panels to control each machine were installed and fly-ball governors were belted to the waterwheel shafts. A cable drum and trigger similar to those at Battle Creek prevent overspeeding. Tripping of the oil switches will also operate the trigger. The induction generator is put on the line by bringing it up to approximately synchronous speed and closing the oil switch. Load is then picked up by opening the wheel gates and raising the generator speed until the machine is taking full load or all the available water.

In both of these plants the only attendance is a visit of inspection twice a day to see that everything is in proper condition and to supply oil if necessary. Trouble that results in tripping a generator off the line requires that some one go to the plant to put the machine on the line again. The cost of attendance has been reduced at these stations to such an extent that the limiting feature of their use is in the maintenance cost of the hydraulic equipment and structures. H. J. BURTON.
Consumers' Power Company,
Jackson, Mich.

Standard Tower Adapted for Switch Mounting

TWO straight-through 30,000-volt transmission lines are tapped to supply a substation, and the two sets of disconnecting switches required are mounted on the steel tower shown in this drawing. This is accomplished by adding supporting steel members to the tower as shown to hold the two sets of disconnecting switches and the insulators which carry the necessary conductors. The switches are so connected that the substation can be fed from either of the lines or from both lines tied together.



TWO LINES TAPPED BY DISCONNECT SWITCHES ON THE TOWER TO AVOID EXPENSE OF A SWITCHING FRAME

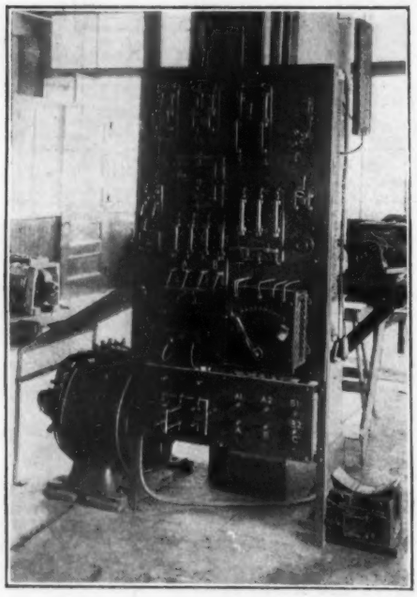
The operating handles of the disconnecting switches are easily accessible from the ground. The lightning arresters and the transformers are shown in the schematic diagram of the entire installation, but the transformers have been omitted from the drawing of the steel structure. F. C. Stanford, electrical engineer of the Cleveland Cliffs Iron Company, Ispeming, Mich., planned and supervised this installation for his company.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Convenient Home-Made Switchboard for Testing Motors

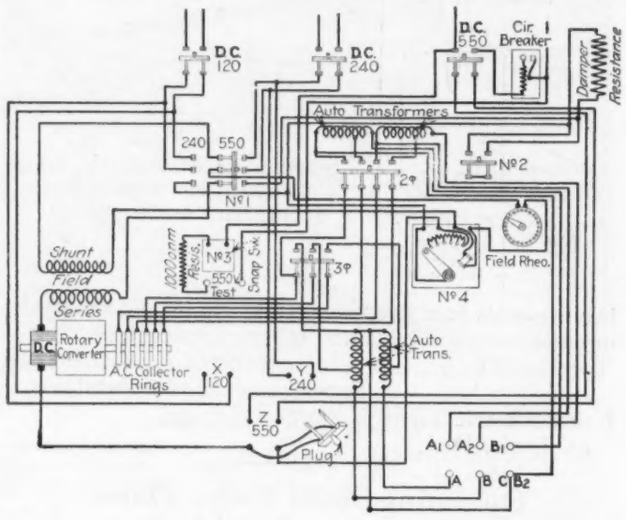
DIRECT-CURRENT and alternating-current motors of any commercial frequency and for 120 volts to 550 volts can be tested on the switchboard made in the shop of the Electric Motor Repair Company, Springfield, Mass. Very simple starting equipment is included in the arrangement which will handle motors as large as 100 hp. Energy for testing is supplied at 120, 240 and 550 volts direct current from a power plant in the building. To obtain alternating current an old 7.5-hp. motor was fitted up as a rotary converter by adding the necessary winding taps and collector rings, and either two-phase, single-phase or three-phase energy is obtained from this machine through the connections and auto-transformers illustrated in the accompanying diagram. The panel is only 80 in. high by 35 in. wide (2 m. x 90 cm.), and on it are mounted ordinary slate-back switches. A wide and smooth range of frequency adjustment is obtained by varying the speed of the rotary converter through shunt-field and armature voltage control. No starting compensators are required. Three direct-current voltages (120, 240 and 550) are used to get the corresponding voltages in alternating current without changing transformer taps and also to give a greater flexibility as far as frequency is concerned. The operation is as follows: For 120 volts, 60 cycles, throw switch No. 1 to the left. This connects the shunt fields and armature across 120 volts. Push plug at the bottom of the board into the holes marked *X* and start the rotary with No. 4 box. Move the field rheostat until proper speed is obtained. For single-phase or two-phase energy connect to the lower terminals at the right marked *A*-1, *A*-2, *B*-1, *B*-2, and throw in the switch marked 2φ. For three-phase energy connect to *A*, *B*, *C* and close switch 3φ.



SEVERAL VOLTAGES AND FREQUENCIES AVAILABLE ON THIS BOARD FOR TESTING MOTORS

For 240 volts put the plug into the holes marked 240 or *Y*. Throw switch No. 1 to the left for frequencies of 50 cycles or over. This will connect the fields on 120 volts and the armature on 240 volts. For lower frequencies throw No. 1 to the right. This will connect the fields of the rotary to 240 volts, reducing the speed and lowering the frequency.

For 550 volts put the plug into holes marked 550. Throw No. 1 switch toward the right only. The fields



WIRING DIAGRAM OF BOARD USED FOR STARTING AND TESTING MOTORS UP TO 100 HP., 550 VOLTS

are then on 240 volts and the armature is on 550 volts.

To lower the inrush on the rotary converter when large motors are started up a damper resistance is connected in series with the motor. When the motor is up to speed switch No. 2 is thrown in, short-circuiting the damper and giving the motor full voltage. This board operates entirely without any other starting arrangements for motors besides the two switches marked 2ø and 3ø. No compensators are used. Motors rated at 100 hp., 550 volts, have been operated without trouble. Switch No. 3 operates a 550-volt circuit used with a 1,000-ohm resistance tube to test for minor grounds or short circuits where a higher voltage is not required.

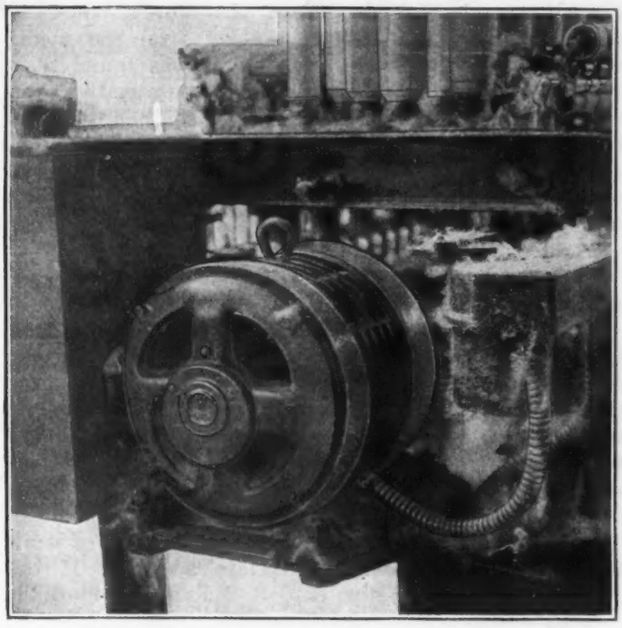
Electric Motor Repair Company, Springfield, Mass. M. HAMAN.

Textile Motors Attached Directly to Spinning-Frame Cylinders

IN CHANGING from group drive to individual motor drive of 128 ring spinning frames at the Indianapolis (Ind.) Bleaching Company some time ago the motors were attached directly to the frames without moving the existing machines. Previously the machines were driven through line shafts attached to the ceiling. These line shafts were removed and the motors were mounted on cast-iron brackets fastened to the end of each spinning frame. They were connected directly

to the cylinders on the Lowell frames. The diameter of the cylinders did not have to be changed as the proper motor to give the correct speed was obtained. These motors are 5-hp., three-phase, 550-volt, 60-cycle, 1,150-r.p.m. Westinghouse textile motors.

The motors are controlled by textile drum-type switches with the shipper-rod device which was formerly used with belt drive. The switch is attached to a shipper rod on the frame so that the motors and machines can be easily started and stopped from either end. By the utilization of this control the change-over has no effect upon the operation, and the



INDIVIDUAL DRIVE MOUNTING ON END OF LOWELL SPINNING FRAME

machine is handled in the same manner as it was before. Directly below the switch are the fuses for the motor entirely inclosed in the steel cabinet. Connections from the switch and fuse box to the motor are made through wires covered with flexible steel conduit.

By the installation of the motors driving the machines directly all shafting was eliminated. This resulted in better lighting and decreased noise. Furthermore, the maintenance of bolts and shaft bearings was obviated and the possibility of oil dropping on the frames was removed.

L. R. WEST.

Indianapolis, Ind.

Maintenance Costs per Motor Average 50 Cents a Month

THE cost of maintaining about 1,500 220-volt, three-phase, 60-cycle motors, ranging in size from ½ hp. to 225 hp. and aggregating about 2,200 hp., averages 50 cents per motor per month in the plant where the writer is connected. The motors are up to twelve years old and have probably been in service, on an average, five years. The cost given is an average for the past six months and includes the labor and material for replacing contacts, burned-out windings and bearings, the labor of inspecting, oiling and testing the motors, plus the regular factory overhead expense.

With the exception of the time given to the renewal of lamps and making repairs to the lighting system, three men devote their entire time to keeping the motors running and properly loaded. These men inspect the motors about twice a week, but some motors like the synchronous machines driving the air compressors are inspected only once a week, while there are 20-hp. and 30-hp., 3,600-r.p.m. blower motors which are inspected four times a day. The motormen are held responsible for keeping the motors fully loaded, and if manufacturing conditions change so that a motor appears to be overloaded or underloaded, they have an ammeter cut-in circuit and report the load to the office. They are then instructed to change the motor to one of the proper size for the load.

During the past seven years a 185-hp. synchronous motor and a 30-hp. wound-rotor induction motor were the only large motors that were burned out. All the other machines that have been sent in to the shop for rewinding have been of 10 hp. or less. A repair force of one armature winder and a helper is maintained, but in addition to the rewinding, which comes under the head of motor maintenance, these two men repair electric tools, chucks, etc.

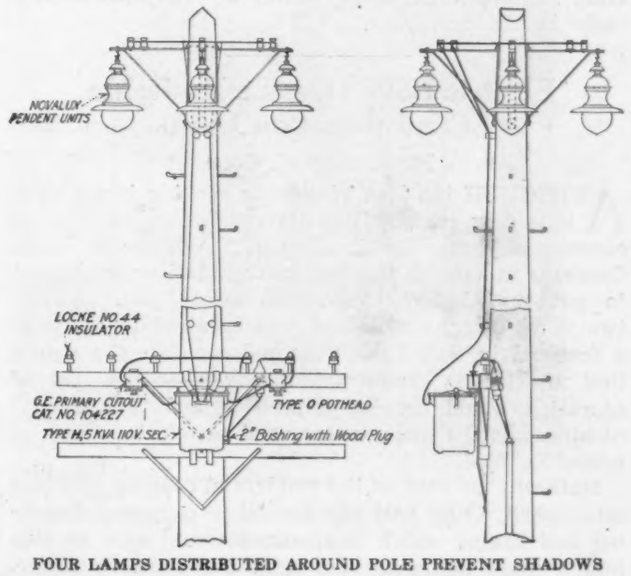
H. L. BURNS,
Chief Electrician.

Domestic Engineering Laboratories Company,
Dayton, Ohio.

Yard Lamps and Transformers Carried on Same Pole

TRANSFORMERS, lamps for lighting the yards and all distribution lines are carried on the same pole in the Hog Island shipbuilding yards. Four of these lamps are supported on strap-iron brackets near the top of the pole, so that there is light on all sides of the pole. The transformer with its cut-outs is mounted on a cross-arm several feet below the lighting units, and secondary wires are run on porcelain knobs up to the lamps.

This type of construction was used to save the cost


NOVALUX PENDENT UNITS
LOCKE NO 44 INSULATOR
G.E. PRIMARY CUTOUT CAT. NO. 104227
TYPE H, 5 KVA. 110V. SEC.
TYPE O POTHEAD
4-2" Bushing with Wood Plug

FOUR LAMPS DISTRIBUTED AROUND POLE PREVENT SHADOWS

of erecting separate poles. All distribution was necessarily overhead in these yards because changes in the buildings were repeatedly being made and underground work was in danger of being torn up at any time.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Power Shortage Relieved by Isolated Plants

"I WOULD as soon give a little extra money to the utility as to pay it to the government in taxes," said a prominent business man in the Twin Cities when the St. Paul Gas Light Company asked him to operate his isolated plant for three and a half months this winter to tide the company over its winter peak. This is typical of the help being given the St. Paul central station company by many downtown business men and factory executives who are temporarily operating their isolated plants, some of which have been shut down for a number of years. With this arrangement it will not be necessary for the utility to curtail the electric service to its customers. It will increase the cost of service to these large customers, but they get much lower rates than the smaller customers, and, realizing the predicament of the utility and its customers, they are willing to stand the extra expense.

The Milwaukee Electric Railway & Light Company also is receiving help from the isolated plants of Milwaukee. For a number of years it has had agreements for interchange of power with some of its large industrial customers. This year the power shortage is more acute, so in addition to utilizing the available generator capacity of these large customers, the company is connecting up to industrial concerns which are not customers and is purchasing their surplus energy. This condition will be relieved when the Milwaukee utility can start its new pulverized coal-fired generating station, which will probably be ready for service early in the new year.

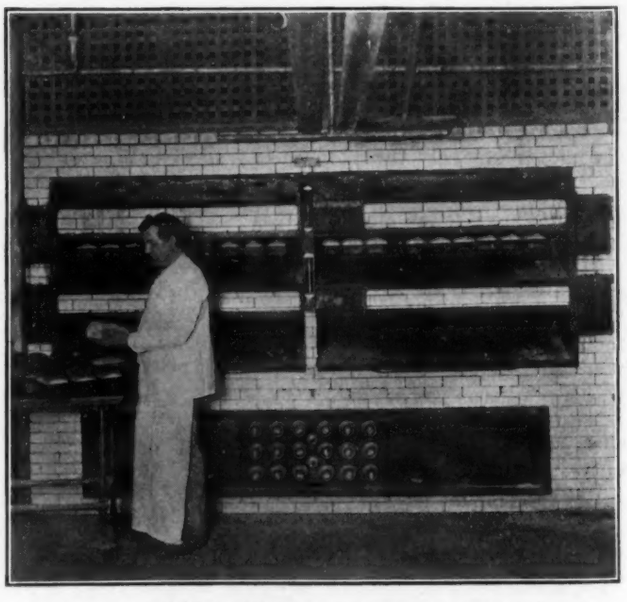
Electric Bake Ovens a Desirable Central-Station Load

BY GEORGE W. COLE

ALTHOUGH the idea of electric cooking is not new, it is only recently that its application has become commercially successful. The Utah Power & Light Company was one of the first central stations to attempt to put the electric range into actual use. Nearly two years of constant effort was required to establish a foothold in Salt Lake City and convince the people that an electric range would cook, that the cost of operation would not be prohibitive and that electric cooking was the most modern and satisfactory way of preparing food.

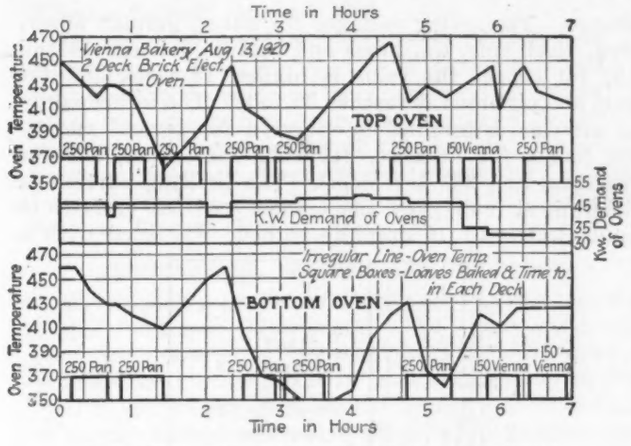
Naturally, as soon as the residential cooking idea was established, a new field was opened in commercial cooking and baking which it appeared would soon develop into a more desirable load than the domestic range. The first few customers were skeptical—the idea of domestic cooking was all right, but turning out foodstuffs in commercial quantities was apparently out of reason and the price presumably would be proportionately out of line. A demonstration of an electric oven in one of the largest retail stores secured the first order. The Utah Power & Light Company furnished everything and allowed the store's baker to operate the oven. After a six-day trial the meter was read, the output checked, and it was found that, instead of being more expensive to operate, the oven actually did more work at less expense than the fuel then used by the store. From the first installation of this oven sales have steadily increased until at present there are about forty ovens working every day in Salt Lake City and about twenty in use in other sections of the company's territory.

This company looks upon the bake oven as a very desirable business as it is in steady use from five to sixteen hours each day and maintains a fairly high load factor. The investment cost to obtain this business is little or no greater for smaller-size ovens than for the electric range and revenue returns equal eight to ten ranges. In most cases no additional investment is necessary as the load is connected in the commercial section, where feeders and transformers are of ample capacity to handle a greatly increased load. The baking hours are so arranged by the class of work that the operation seldom overlaps a peak. If the oven is used during the day, it misses the morning peak and is turned off before the evening; if used during the night, it also misses both morning and evening peaks, thereby improving the load factor by filling in the valley of the load curve that is a problem to all central-station engineers.



DOUBLE-DECK BRICK TYPE ELECTRIC OVEN, CONNECTED LOAD 88 KW.

The largest oven connected in Salt Lake City is a Hughes No. 415 brick-type electric oven with a connected load of 88 kw. This oven has been in use for three years and has proved very satisfactory. It is operated on a load-factor rate, and to keep operating cost as low as possible tests have been made to find the lowest demand on which the oven can operate and maintain the maximum output of bread. A series of tests has been made and 50 kw. demand shows


Time in Hours
Vienna Bakery Aug 13 1920
2 Deck Brick Elect. Oven
TOP OVEN
250 Pan 250 Pan 250 Pan 250 Pan 250 Pan 250 Pan 150 Vienna 250 Pan
K.W. Demand of Ovens
Oven Temperature
Kw. Demand of Ovens
Irregular Line - Oven Temp.
Square Boxes - Loaves Baked & Time to in Each Deck
BOTTOM OVEN
250 Pan 250 Pan 250 Pan 250 Pan 250 Pan 150 Vienna Vienna
Time in Hours

OPERATION CURVE OF ELECTRIC OVEN MAXIMUM DEMAND 50 KW.

the greatest efficiency. With this maximum it is possible to bake bread as fast as it can be cooked through without burning and with no appreciable loss in temperature in the oven. The bakery is turning out a 19-oz. loaf, 250 in each deck, baked in thirty minutes. The output of this bakery is 10,000 loaves daily, approximately 34 per cent of which is baked in the electric oven, the rest in three brick ovens. The accompanying diagram shows the operation curve of this oven for a typical day.

Available figures on all the ovens in use in Salt Lake City show that the average demand is about 50 per cent of the name-plate rating. This, of course, is dependent on the number of hours' use, but over an eight-hour baking period it holds true. Longer hours reduce this percentage somewhat and a shorter use necessarily increases it, but the average holds.

From the customer's standpoint the oven is very desirable as it does the work that any fuel-fired oven will do and does it better. The ovens are especially adapted for high-class pastry work, as uniform heat distribution, perfect control and the absence of dirt or fumes make them particularly suitable for this kind of baking.

One representative installation turned out during twenty-six baking days:

Cream puffs	1,800	Tarts	540
Cup cakes	2,160	Apple turnovers	540
Package squares	720	Layer cakes	300
Buns	3,600	Cinnamon rolls	3,000
Filled rolls	1,800	Buttered rolls	1,800
Bath buns	1,080	Parker House rolls	3,600
Sausage rolls	920	Biscuits	1,080
Pies	450	Corn bread	270

This represents a consumption of 1,525 kw.-hr. Two ovens baked 3,000 pies and 5,250 layer cakes in the same time.

Pacific Gas & Electric Reports Record Increase of Customers

THE Pacific Gas & Electric Company of California reports an increase in the number of customers on the company's distribution system at a rate unprecedented in its history. In the first nine months of the current year 28,995 new consumers were added to the company's lines. The total gain for the year was 57,566, of which 37,500 represented normal growth. The remaining 20,066 were brought on the company's books through its purchase of the Northern California Power Company, Consolidated and the Sierra & San Francisco Power Company. The normal growth for the month of September alone showed a net addition of 5,075 customers.

Central-Station Office on Tip of Cape Cod

QUAINT old Cape Cod ends at Provincetown, Mass., and a central-station office and appliance salesroom are one of the "attractions" for summer visitors and year-round denizens of this picturesque spot. Energy is distributed to about 800 all-year customers by the Provincetown Light Company, and notwithstanding the absence of day service, about 500 electric flatirons are in use on the system. The present rate is 20 cents per kilowatt-hour. Electricity is purchased from the Cape Cod Cold Storage Company, and the lighting load includes motion-picture establishments, stores, hotels and bungalows in the artist colonies as well as the snug

CENTRAL-STATION OFFICE AND ELECTRIC SHOP AT TIP OF CAPE COD

retirement quarters of former sea captains. Little or no power business is in sight in this territory, apart from the operation of refrigerating plants, which at present are steam-driven. The one electric shop of the town, as shown, was formerly a private residence.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

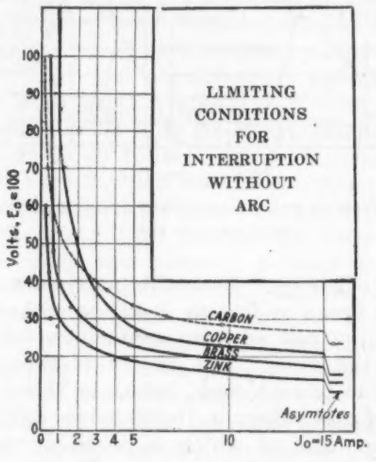
Construction of Alternating-Current Generators.—S. L. HENDERSON.—In the first of these two articles ventilation of alternating-current generators is discussed, with a comparison between radial and axial ventilation schemes, while the second deals with the construction of rotors, with special reference to the subject of slotting.—*Electrical Review*, Sept. 4 and Oct. 2, 1920.

Continuous, Occasional and Intermittent Loading of Electric Motors.—BLANC.—Since the rating of a motor is fixed by maximum temperature attained when working it will depend on the conditions of load; that is, on whether the load is continuously, occasionally or intermittently applied. The author investigates the heating conditions in an intermittently loaded motor which within a relatively short time period passes through a full cycle of loading, so that it runs at full load during a certain time but is unloaded during the rest of the loading cycle. The rating of the machine, or safe working load, then is a function of the loading factor, or ratio of full-load time to idle time for one load period. It is difficult to test a machine under intermittent load. The author, however, presents formulas by means of which the intermittent rating for a given loading factor may be computed from the continuous rating.—*Elektrotechnische Zeitschrift*, Oct. 14, 1920.

Generation, Transmission and Distribution

Planning, Designing and Erecting Transmission Lines.—ALFRED STILL.—The author explains the economic considerations encountered in laying out a line and shows the importance of the preliminary work leading up to the location of supporting structures, methods of erecting and anchoring steel towers, setting the wooden poles, etc.—*Electrical Review*, Oct. 2, 1920.

Current Interruption Without Arc.—BURSTYN.—The paper begins with a detailed review of an article by Kraus (*Elektrotechnik und Maschinenbau*, 1913, vol. 31, page 717) describing the results of certain investigations made to determine the conditions which permit arcless interruption of continuous current. An analysis of the Ayrton arc formula leads to certain relations between current and voltage in the case of infinitely short, or negative, arc length, and Kraus succeeded in proving experimentally that a well-defined limiting state exists when the arc length is zero—that is when no arcing occurs. Burstyn now reports on more recent researches, the results substantiating Kraus' work. The limiting conditions involve only the current before interruption, and the voltage after complete interruption in circuits without inductance and capacity. Below the so-called *arcing voltage* any current strength may be interrupted without an arc. For higher voltages arc-free current is rapidly getting smaller, and from the cathode drop voltage on even the smallest current will give rise to an arc or, at least, to a luminous discharge. The arcing voltages for silver, german silver, iron, steel, zinc, tin, brass and lead lie between 14 and 16; for copper the value is higher, 18 volts, and for gold and platinum it reaches 20 volts. The cathode drop in air was determined by Burstyn for several metals. He found, for instance, 310 volts for copper, 305 for platinum and 285 for nickel. The limiting current is determined mainly by the tendency of the cathode to emit electrons. If graphite cathode was used with a



platinum anode, at 200 volts, the limiting current was 0.190 amp. However, when the current was reversed up to 2.8 amp. could be interrupted without any arcing. For most metals the limiting current at 200 volts lies around 200 millivolts. A set of curves given by Kraus, which show the limiting conditions for different metals, is reproduced. For all voltage and current values which plot below the curve interruption will take place without arcing.—*Elektrotechnische Zeitschrift*, June 30, 1920.

Washery Sludge Burned in Pulverized Form at Seattle.—CHARLES H. BROMLEY.—During the war, when it appeared that the government might restrict the use of oil for steam-raising purposes in the vicinity of Seattle, a study was made of the possibility of utilizing local grades of coal in pulverized form. An outcome of this study was the efficient utilization of a 200,000-ton sludge dump at the Renton mine just outside the city limits. In adopting this fuel there was the important advantage of leaving the existing oil-burning equipment immediately available in efficient form. Details of preparing the coal for burning are given.—*Stone & Webster Journal*, September, 1920.

Traction

Single Phase in Thirteen Years' Successful Operation on the Erie.—Q. W. HERSHEY.—Feeders to the Erie Railroad between Rochester, Avon and Mount Morris have been electrified and are using Niagara power. Twenty-five-cycle, three-phase energy at 60,000 volts is transformed to two-phase, 11,000 volts by means of a

simple transformer substation requiring no manual attendance. It is said that during thirteen years of operation no general tie-up of the railroad existed at any time from storm conditions with the exception of one last year, during which the steam roads in the vicinity were tied up from ten hours to three days, whereas the electrical section was tied up for only four hours. The operation of the system, including station lighting, car heating and repair shops, is carried on with a ton-mile energy purchase of 79 watt-hrs.—*Electric Journal*, October, 1920.

Electric Braking of Direct-Current Vehicles.—W. M. HUTCHISON.—The term electric or dynamic braking is said properly to refer to the braking effect secured by converting the propelling motors to series generators driven by the momentum of the vehicle. Rheostatic braking, magnetic braking and emergency dynamic braking are specifically discussed in this article.—*Electric Journal*, October, 1920.

Installations, Systems and Appliances

Electrical Equipment of the Super-Power Station at Golpa, Germany.—H. PROBST.—The steam generating plant at Golpa from the beginning was intended to provide the nitrogen-fixation plants at Piesteritz with 500,000,000 kw.-hr. of electrical energy a year and also to supply a large nitric-acid plant in the neighborhood with about half of this amount. The generating plant is located close to a lignite mine, and cable cars take the coal directly from the mine to the stokers. The daily consumption is 7,000 tons. There are sixty-four steam boilers, feeding eight A. E. G. turbines, each coupled to one 22,000-kva. generator for 6,000 volts and 50 cycles. From five of the units power is transmitted over a 25-km. (15.5-mile), 80,000-volt line to Piesteritz. After the shutdown of the war-time nitric-acid plant the output from the other units was taken over by the city of Berlin, the power being transmitted over a 125-km. (78-mile), 110,000-volt line (see Digest, Jan. 17, 1920). The Golpa generating plant, the switching equipment and the transmission lines are described in detail in this article, which is richly illustrated.—*Elektrotechnische Zeitschrift*, Sept. 2, 1920.

Electrophysics and Magnetism

Self-Oscillations and Critical Frequency in Single-Layer Coils.—GOTHE.—This problem has been attacked by several German writers, with widely different results. Rüdenberg, Böhm and Wagner replace the coil, for purposes of analysis, by an artificial line with capacity and mutual induction between sections. In this way Wagner was led to the conclusion that every coil has a number of self-oscillating frequencies, forming a series which converges upward toward a certain limiting "critical frequency." Rogowski, using an entirely different physical scheme (see Digest of Jan. 1, 1920), showed that there is a fundamental lowest frequency and above this an infinity of higher modes of oscillation such that their frequency ratios approach the series of integer numbers. The present author has made an experimental investigation of high-frequency oscillations in two large specially built single-layer coils. The coils were excited from a vacuum-tube oscillator, and the current distribution in the winding was observed with little search coils, carried on glass rods close to the coils and connected to wave-meter circuits with thermocouples. In this way no fewer than thirty successive harmonic oscillations were observed on a coil of 46.8 cm. (18.5 in) length and 19.75 cm. (7.8 in.) diameter. The fundamental wave length was 645 m., and in the thirtieth mode of oscillation the coil had a wave length of 31 m. The ratio of successive overtone frequencies corresponds well to the Rogowski theory, and the author concludes that the Wagner-Rüdenborg sectionalized "artificial coil" does not represent the real facts. Values of self-oscillating frequencies computed according to the Lenz formula for short coils were found to check within 10 or 20 per cent with measured values. Bundles of transformer plate inserted in the coils increased the wave length of the lower harmonics enormously, but had almost no effect on the higher ones.—*Archiv für Elektrotechnik*, April 15, 1920.

Telegraphy, Telephony and Signals

Wave-Length Relation for a Generalized Bessel's Antenna.—A. PRESS.—The differential equations for an antenna of negligible resistance and leakage conductance are set up. Proceeding from previously deduced values of the inductance and capacity per centimeter along the antenna, the solution is obtained in terms of Bessel's functions for the voltage and current distribution along the antenna. After simplification, the solution is interpreted and curves enabling its ready employment are given.—*Proceedings Institute of Radio Engineers*, October, 1920.

On Beat Reception.—MEISSNER and SCHEIFFLER.—The article contains a number of experimental curves concerning interference reception in radio-telegraphy and showing audibility as a function of received current and of superposed current. When pyrite detectors were used, the audibility was found to be practically proportional to the received current. On the other hand, when the superposed current was increased the audibility gradually increased toward a maximum value, decreasing for still greater superposed current strength. Similar conditions were found when using an audion detector, in grid-condenser connection. For large grid-leak resistances a limiting value of audibility was observed, which stayed constant, whatever the adjustment of the superposed current, above a certain critical value; but for smaller grid-leak resistance the audibility curve showed a pronounced maximum at a certain value of superposed current. Damped oscillations, it was found, can be amplified by interference reception if the following conditions are fulfilled: (1) The audion bulb must work at the lower bend of the characteristic curve. (2) The superposed current must be out of tune with respect to the received current so that a phase change of 180 deg. will take place between two wave trains. (3) The trains must not be so long that they run into each other. Clear tones, however, could be obtained only for wave lengths below 1,000 m. (decrement < 0.04, 1,000 sparks per second).—*Zeitschrift für Fernmeldetechnik*, Nos. 2 and 3, 1920. (For an extensive abstract see *Elektrotechnische Zeitschrift*, Sept. 16, 1920.)

Miscellaneous

Electric Heating.—de LA BROSSE.—The author sharply opposes the idea of using night power for heating purposes, stating that whenever electric power is produced by steam-driven machinery the use of electric current for heating will be a waste. Even when electric power is produced by hydraulic machinery, the author says, the energy should be reserved for mechanical and electrotechnical purposes rather than used for heating.—*Revue Générale de l'Electricité*, Sept. 11, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

HERBERT C. HOOVER was elected president of the American Engineering Council, the governing body of the Federated American Engineering Societies, at the Washington convention of the council. A quantitative study of the waste occasioned to industry by intermittent employment, non-employment, strikes and lockouts is to be made as one of the first activities of the new organization, which has a large tentative program before it. Charter-member societies may come in up to July 1.

OPPOSITION to the merging of the old Engineering Council into the new American Engineering Council set up by the Federated American Engineering Societies has been expressed by the American Society of Civil Engineers, whose representatives on the old council have been instructed not to consent to the change. Under the council's rules this will block action.

INTERCONNECTION and storage are given as the chief elements in the cure for coal troubles in a recommendation drafted by Herbert C. Hoover for a committee of the American Institute of Mining and Metallurgical Engineers.

FIFTEEN orders for turbines rated at from 20,000 kw. to 35,000 kw. constitute a partial list of the large turbine orders received in the last year by the General Electric Company.

FUTURE prices of coal, process coal, return of power to the line and need of broader state legislation were among the topics discussed at Super-Power Survey meetings held recently.

A REFERENDUM vote on the street-railway situation, based on eight recommendations by its committee on public utilities, is being taken by the United States Chamber of Commerce. The recommendations favor private ownership with prompt and flexible regulation and oppose unfair competition.

THE HIGH prices of today will not be accepted by the California Railroad Commission in valuation proceedings to fix a rate base, according to an expression of opinion by Commissioner Devlin.

NOTHING fundamentally wrong exists in the business situation at the present time, according to the views of F. H. Goff, president Cleveland Trust Company, as expressed before the Electrical Supply Jobbers' Association. He looks for almost normal conditions to prevail in the business world with the arrival of early spring.

REPORTS of a fair amount of buying come from the different sections of the country, improvement over the recent past being noted in some instances. Supplies of electrical materials are in good volume, jobbers are expending greater sales effort, and stocks are moving. Reductions running as high as 30 per cent in the prices of building material are reported, following the investigation into the housing situation in New York, but construction activity remains at a low ebb. Cancellations and price cutting are not creating the havoc that was feared a few weeks ago.

THE SUPER-POWER committee of the American Institute of Electrical Engineers is to meet with the engineering staff of the Super-Power Survey on Dec. 3. An important meeting of the advisory board of the Super-Power Survey is scheduled for Dec. 1.

S. B. IRELAND of Montgomery, Ala., was elected president of the Southeastern Section, N. E. L. A., at its Miami (Fla.) convention. The third vice-presidency and two memberships on the executive committee were accorded to the manufacturers.

A SWEDISH commission consisting of three prominent engineers is now in the United States studying railway electrification. Sweden is soon to electrify the 300 miles of track between Stockholm and Gothenburg. A 220-volt transmission line between the super-power plants at Trollhättan and Alfkarleby is also to be erected.

KANSAS is to hold a water-power congress at Topeka on Dec. 15 to adopt a state policy on its water resources.

MANY public utilities are reported to be still badly off for coal. This is particularly true of those using gas coal from certain regions.

BY RESOLUTION of the board of directors of the A. I. E. E., only a limited number of technical papers will be presented at the Salt Lake City convention next year, and the midwinter convention will be made the heavy technical meeting of the Institute.

ELIMINATING trouble makers was held by Henry L. Doherty, speaking before the H. L. Doherty Organization, to be the best method of stimulating production, active co-operation between employers and employees the second best, and wage reductions the last resort.

AUTHORITY to issue $30,000,000 of 7 per cent ten-year bonds and to increase the capital stock of the company from $75,000,000 to $125,000,000 was granted to the Westinghouse Electric & Manufacturing Company at a special meeting of stockholders.

A POLICY of close co-operation with the Forest Service in giving priority in Alaska to applicants purchasing timber is announced by the Federal Power Commission. The legal situation developed by the withdrawal of water above Niagara Falls is to be investigated.

PROGRESSIVE standardization during the next ten years was predicted by President James Burke at the semi-annual meeting of the Electric Power Club at Hot Springs, Va. Co-operation in creating public sentiment in support of utilities was discussed by Martin J. Insull, president of the N. E. L. A., and the relations of the Electrical Manufacturers' Council to the Electric Power Club and other bodies were explained.

AN ABSENCE of domestic interest in steel transmission towers is reported, although foreign orders and inquiries are active. Italy, France, the Scandinavian countries, Japan and South America afford the most promising markets.

THE LONG scarcity of pliers and other linemen's tools due to the absence of exportations and the scarcity of skilled tool makers is nearly over, and it is said that pliers will soon be available on sixty-day and eighty-day orders, instead of in twelve to eighteen months.

EXCELLENT commercial results are reported in Montana from the first electrical show of that state, held recently in Butte.

A BRIGHTER side to present trade conditions is being seen by electrical jobbers in New York territory, who find that demand compares fairly well with normal business periods.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Doherty Would Stimulate Production by Throwing Out Trouble Makers

REDUCTION in production costs can best be accomplished by the elimination of trouble makers, with the consequent disappearance of friction within an organization, Henry L. Doherty told the 300 members of the H. L. Doherty Organization who met in New York on the first three days of this week. The next best way, Mr. Doherty said, was to stimulate production by active co-operation between employers and employees, and lastly came the method of wage reductions.

In taking over public utilities Mr. Doherty said that the aim of his organization was not to "clean house" by a general discharge of all old employees but to take over the organization and retain its members just as long as they co-operate and follow the parent company's methods.

This meeting was in line with the practice of the Cities Service Company to call its managers together every year or eighteen months for a general conference. At this time particular stress was put upon questions of public policy and the necessity of rate adjustments to meet present operating costs. In addition to various company problems which were discussed, a general plan of operations was outlined for the coming year.

Many Utilities Still Suffer from the Coal Shortage

DESPITE a gradual improvement in the general coal situation many public utilities are in very bad condition. This is particularly true of those dependent on the gas-coal region served by the Louisville & Nashville Railroad and those using Monongahela gas coal. Utilities drawing their supplies of coal from the central Pennsylvania region are now getting better deliveries.

California Commission Will Not Base Rates on Present-Day Costs

THAT the high prices of today will not be accepted by the California Railroad Commission in arriving at a rate base on which to allow a reasonable return was the declaration of Commissioner Frank R. Devlin made at a recent hearing of the application of the Great Western Power Company for a permanent adjustment of its rates for electricity. "I hold this view personally," said Mr. Devlin, "and I am sure that the other members of the commission will agree with me."

Commissioner Devlin made the declaration following the discussion of the methods to be pursued in fixing the value of the properties of the Great Western Power Company for the purpose of rate fixing, during which it was brought out that among the valuations to be submitted by the power company to the commission in the proceedings was one based on reproduction cost new as of June 30, 1920. Company representatives announced that it was not their intention to base their request for a reasonable return on this type of valuation. They said it would be presented as a measure of aid in arriving at a proper valuation.

Coal Prices Receive Attention in Super-Power Survey

SINCE the price of coal in the future has a direct bearing on super-power plans, there has been some discussion at the Super-Power Survey meetings as to coal prices a few years hence. All agree, apparently, that coal will not go back to its pre-war price. One of those present at a recent meeting predicted that it would go as low as $2. Samuel Taylor was quoted as estimating that coal bought in large quantities on contract would be worth $3.25 in 1926 and $3.50 in 1927. After considerable speculation as to the probabilities in that connection the whole matter was referred to C. E. Lesher, editor of *Coal Age*, with the request that he estimate the price level which will become the new normal one.

That the engineers on the Super-Power Survey are taking process coal seriously may be judged from the fact that room for a process plant probably will be provided when it comes to selecting sites for the super-power plants.

Some evolution of thought has taken place among the super-power engineers in regard to the return of power to the line. There was a very general opinion at first that this practice would do much to equalize the load factor, but such investigation as has been had leads to a half-formed conclusion that any general effort to return power to the line would probably lower materially the factor of reliability.

Attention has been called to the need of broader legislation in certain states. In Pennsylvania, for instance, condemnation proceedings may not be resorted to for transmission lines in steam systems. In the same state power producers are not permitted to share with the public earnings growing out of economies, the Super-Power Survey has been informed.

Attention of the survey has been called to a site in the anthracite-coal field where sufficient water exists to take care of condensing for a plant of 200,000 kw. or 300,000 kw.

The work of the Super-Power Survey may be divided into three periods. The first three months were devoted to a study of the broad outlines of the problem, in an effort to choose the elements which must be considered. The second period is that in which the necessary data are assembled. The survey's work is now in this second period. The third period is the one in which the data will be digested and the report written. There is the

fullest determination to have the report in the hands of the Secretary of the Interior not later than June 30, 1921.

A. I. E. E. to Emphasize Social Activities at June Convention

ONLY a limited number of technical papers will be presented at the annual convention of the American Institute of Electrical Engineers to be held next year at Salt Lake City so that more time can be devoted to discussion and to social activities. The heavy technical meeting will be the midwinter convention. This action was taken at the Nov. 12 meeting in Chicago of the board of directors in a resolution which read as follows:

Resolved, that the board hereby confirms its action of last spring to the effect that the social features of the summer convention benefit and strengthen the technical interests of the Institute and the engineering profession, and reaffirms as a policy of the Institute that the principal meeting of the year for the presentation of technical papers shall be the midwinter convention, an dthat the program of the annual convention in June shall include only a limited number of technical papers, to be presented in not exceeding four sessions, with ample time for discussion, thus allowing time for excursions and other social features which may be arranged by the convention committee.

The board also called attention to the present high cost of Institute publications and urged that these costs be watched as there is little likelihood of any increase in appropriations being granted for the present year. The sum required to complete the printing of the 1920 *Transactions* was omitted from the budget for the present appropriation year because of the existing financial condition of the Institute.

Large-Turbine Orders of General Electric During Past Year

DURING the past year the developments in the central-station field have been largely along the line of extending or completing existing stations, although some large new plants have gone up. In spite of adverse financial conditions orders have been received for a large number of machines of a rating of 20,000 kw. and greater. These machines are of the single-cylinder design.

A partial list of such orders received by the General Electric Company for large turbines during the past year is of interest:

United Electric Light & Power Company, Hellgate station, two, 35,000 kw.

Philadelphia Electric Company, Delaware station, two 30,000 kw.

Beech Bottom Power Company, Windsor station, two, 35,000 kw.

Detroit Edison Company, Marysville station, two 30,000 kw.

Boston Edison Company, Boston, Mass., station, one, 30,000 kw.

Commonwealth Edison Company, Commonwealth station, one, 30,000 kw.

Cleveland Electric Illuminating Company, two, 25,000 kw.

Union Gas & Electric Company, West End station, two, 25,000 kw.

New York Central Railroad, Port Morris station, one, 20,000 kw.

The demand for the intermediate and smaller sizes of turbines, it is stated, has been greater than heretofore experienced.

Power Club Told It Must Take More Active Part in Safety Code Preparation

THE semi-annual meeting of the Electric Power Club was held at Hot Springs, Va., Nov. 15, 16 and 17. The first day was given over to section meetings, of which there were seven, and to meetings of standing committees. President James Burke in his address at the general meeting on Tuesday called attention to the vast amount of work which the committees of the Electric Power Club do and the importance of that work to the electrical industry. He intimated that the work of standardization has only just begun and will in all probability be greatly modified during the next ten years owing to the greater knowledge of materials which has been forthcoming as the result of the work of research laboratories. With reference to progressive work Mr. Burke said that it was obligatory on the Electric Power Club to take a more active part in the preparation of electrical safety codes, since the designers and inventors of electrical apparatus are best qualified to originate such rules.

Prosperity Linked with Utilities

"How the Electric Power Club Can Co-operate with the National Electric Light Association in the Creation of Proper Public Sentiment Toward Electric Public Service Corporations" was the subject of an address by Martin J. Insull, president of the National Electric Light Association. Mr. Insull told of the difficulties confronting electric public utilities in raising money for new developments and extensions—difficulties due to the fact that the earnings of the utilities are such as to preclude the possibility of their competing in the money market with industrial concerns. He said that, backed by a properly informed public, commissions will grant rates sufficient to rehabilitate the credit of the utilities and permit them to obtain sufficient equipment to handle present and prospective business properly. In the campaigns of education now being carried on by the National Electric Light Association, Mr. Insull said, the electrical manufacturing companies could assist by devoting a portion of their advertising space to good-will advertising and by bearing part of the expense of the educational propaganda. Mr. Insull showed how the prosperity of the electrical manufacturing industry was linked in a large way with the continued prosperity of the electric light and power industry.

Frederic Nicholas, secretary of the Electrical Manufacturers' Council, spoke on co-operation and co-ordination between the Electric Power Club and other bodies, explaining in detail the functions of each and their relation to the Engineering Standards Committee. S. L. Nicholson explained the workings of the Electrical Manufacturers' Council.

At the Wednesday session a very excellent report was made by the cost accounting committee, of which H. L. Stratton of Cleveland is chairman. The committee discussed what relates to cost accounting rather than cost accounting itself and gave consideration to swollen and ragged inventories, management and labor, taxes, cancellations and the status of the industry.

Reports were also submitted by the underwriters committee, the large-power committee, the fractional-horsepower-motor committee, the section on mining and industrial locomotives, the transformer section, industrial control section, power-switchboard and oil-circuit-breaker section, and by the committee on foreign trade.

Hoover Elected First President of Federation

CREATED for public service, the Federated American Engineering Societies got under way last week, electing Herbert Hoover, former Food Administrator and president of the American Institute of Mining and Metallurgical Engineers, as president of the governing body, the American Engineering Council. This first meeting of the council was held at the Willard Hotel in Washington on Nov. 18 to 20, and was attended by delegates from all but one of the twenty-one charter-member societies and by some representatives of bodies that expect to become charter members.

HERBERT HOOVER

Mr. Hoover, in accepting the presidency and later in a prepared speech, indicated in a broad way the part that the federation is to play. He stated that an engineering association stands somewhat apart among other economic associations, such as farmers, bankers, etc., in that it has no special economic interest for its members.

"Its only interest in the creation of a great national association," said Mr. Hoover, "is public service, to give voice to the thought of the engineers on these questions. And if the engineers, with their training in quantitative thought, with their intimate experience in industrial life, can be of service in bringing about co-operation between these great economic groups of special interests they will have performed an extraordinary service. The engineers should be able to take an objective and detached point of view. They do not belong to the associations of either employers or labor, of farmers or merchants or bankers. Their calling in life is to offer expert service in constructive solution of problems to the individuals in any of these groups. There is a wider vision of this expert service in giving the group service of engineers to group problems."

Mr. Hoover also stated that he believed it to be the duty of the federation to undertake a constructive consideration of the problems involved in increasing production and "to give assistance not only to the Federation of Labor but also to the other great economic organizations in this problem, such as the Employers' Association and the Chambers of Commerce."

One of the first activities of the new body will be a survey under Mr. Hoover's direction to determine quantitatively the amount of waste motion in industry. Included in this survey will be the threefold waste in production occasioned by (1) intermittent employment, (2) non-employment arising in shifting industrial currents, and (3) strikes and lockouts.

The meeting was called to order on Thursday, Nov. 18, by Richard L. Humphrey, chairman of the Joint Conference Committee, who reported on the history of the movement and the work done to bring the organization into being. Edwin S. Carman, president-elect of the American Society of Mechanical Engineers, was elected temporary chairman, and temporary committees on program, credentials, constitution and by-laws, nominations, plan and scope, budget and resolutions were appointed.

It was decided to elect only twenty members of the executive board of the council, leaving four vacancies to be filled by other societies which might later become charter members. On the basis of membership the national societies were entitled to fourteen members on the board and the local regional and state organizations to the remaining six places by districts. These districts are:

District No. 1. — New York and New England States.

District No. 2. — Michigan, Wisconsin, Minnesota.

District No. 3. — Ohio, Indiana, Illinois.

District No. 4. — New Jersey, Pennsylvania, Delaware, Maryland and District of Columbia.

District No. 5.—Virginia, West Virginia, North and South Carolina, Alabama, Kentucky, Mississippi, Louisiana and Texas.

District No. 6.—North and South Dakota, Nebraska, Kansas, Oklahoma, Arkansas, Missouri and Iowa.

Territory west of the above states has not been divided into districts.

The elections to the executive board were as follows:

American Institute of Chemical Engineers.—Harrison E. Howe.

American Institute of Electrical Enginers.—H. W. Buck, William McClellan, Charles F. Scott, Lewis B. Stillwell.

American Institute of Mining and Metallurgical Engineers.—Arthur S. Dwight, Edwin Ludlow, Philip N. Moore.

American Society of Agricultural Engineers.—Samuel H. McCrory.

American Society of Mechanical Engineers.—L. P. Alford, Arthur M. Green, Jr., E. S. Carman, Fred J. Miller.

Taylor Society.—M. L. Cooke.

District No. 1.—W. B. Powell, Engineering Society of Buffalo, N. Y., or Bion E. White, Mohawk Valley Engineers' Club, Utica, N. Y.

District No. 2.—B. A. Parks, Grand Rapids (Mich.) Engineering Society, or D. J. Sterrett, Detroit Engineering Society.

District No. 3.—J. F. Oberlin, Cleveland Engineering Society.

District No. 4.—W. W. Varney, Engineers' Club of Baltimore.

District No. 5.—O. H. Koch, Technical Club, Dallas.

District No. 6.—L. B. Smith, Kansas Engineering Society.

After a long discussion Washington, D. C., was chosen as the place to establish headquarters. The appointment of a secretary was given over to the executive board, which has named a committee, composed of L. W. Wallace, Philip N. Moore, Charles F. Scott, John F.

Oberlin, L. P. Alford and Calvert Townley, to report a list of qualified persons.

It was decided to extend until July 1, 1921, the time within which societies may become charter members.

Officers were elected on Friday, the election resulting as follows: President, Herbert Hoover, American Institute of Mining and Metallurgical Engineers; vice-presidents for two years, Calvert Townley, American Institute of Electrical Engineers, and W. E. Rolfe, Associated Engineering Societies of St. Louis; vice-presidents for one year, Dexter S. Kimball, American Society of Mechanical Engineers, and J. Parke Channing, American Institute of Mining and Metallurgical Engineers; treasurer, L. W. Wallace, Society of Industrial Engineers.

Some minor changes were made in the constitution and by-laws to make for smoother operation. An attempt was made to change the section relating to publicity, but it was voted down.

A report by the committee on plan and scope indicated a number of activities, many of which are inherited from the Engineering Council, in which the new organization could well engage. The following list was presented and is not supposed to be exhaustive:

1. Serving the public interest by investigation and advice to the public and to governmental and voluntary bodies upon national problems which involve industrial and economic questions.
2. Furthering the proposed national Department of Public Works.
3. Conservation of national resources, such as water, coal, oil, etc.
4. Maintenance of a co-operative attitude toward other national organizations, both professional and commercial.
5. Technical education.
6. Transportation in its various forms, particularly highways.
7. Advice with and assistance to regional, state and local organizations upon their request.
8. National Bureau of Economic Research.
9. Public fire prevention.
10. Patents.
11. National Board of Jurisdictional Awards.
12. International Affiliation of Engineers.
13. State organization of local affiliation.
14. Uniform licensing and registration laws.
15. Classification and compensation of engineers.
16. Bureau of employment.
17. Russian-American engineers' committee.

This committee in concluding its report said: "Every care should be exercised to avoid any action partaking of political bias or partisanship and to keep the activities and pronouncements of the Federated American Engineering Societies within the pale of sound engineering, good judgment and upon the broad basis of a real and mutual co-operation."

The executive board met on Saturday morning and appointed L. P. Alford as its temporary secretary. A resolution was passed recognizing the importance of the movement for a national Department of Public Works.

Civil Engineers Take Steps to Block Federation

IT BECAME known last week that the American Society of Civil Engineers, which voted not to become a charter member of the Federated American Engineering Societies, has taken steps to hinder the functioning of the new American Engineering Council of the federation by trying to perpetuate the old Engineering Council.

The board of direction of the society instructed its representatives on the Engineering Council that they "cannot participate in any action by the Engineering Council in transferring its activities to the Federated American Engineering Societies," and also "to express to the council its hope that the Engineering Council will for the present continue to carry forward its work."

The Engineering Council was formally to cease functioning on Jan. 1, when it was to place all of its files of unfinished business in possession of the new body. At that time the supporting societies with the exception of the civil engineers will begin to support the new organization. Under the rules of the old Engineering Council that body can take no action with the members of one of the founder societies voting against it. This whole matter will probably come to a head at the meeting called for Dec. 16.

Nothing Fundamentally Wrong with Business, Banker Tells Jobbers

NINETY-SIX electrical jobbing houses and 304 manufacturers were represented at the semi-annual convention of the Electrical Supply Jobbers' Association, held at the Hotel Cleveland, Cleveland, Ohio, Nov. 17, 18 and 19. The opening day's sessions were reported in last week's ELECTRICAL WORLD, and on page 1092 of this issue there appear in full the figures presented by Chairman Thomas of the committee on costs, showing the jobber's expense for handling each of twelve representative lines.

F. H. Goff, president of the Cleveland Trust Company, discussed the general financial and business situation saying that nothing is fundamentally wrong with trade or industry. He said that the public has simply held off buying, believing that the bottom of the swing in prices has not yet been reached. The speaker ventured the prediction that if liquidation goes on as at present, the early spring would see general conditions almost normal again. With the enhancement of interest-bearing securities, that season would be a better time than now for financing a business by issues of bonds.

Resumption of active conditions in the spring may, however, bring on another later crisis, unless labor meanwhile also liquidates. The deflating process must go slowly, and present values, which were three or four years in inflating, should have a similar period for orderly descent. Mr. Goff counseled patience among groups in all industries, urging business men, at this time above all others, to be considerate of each other.

On Thursday morning A. A. Gray, counsel for the association's publicity committee, told of the committee's plans for extending its publicity work and made a plea for sympathetic co-operation by association members with the electrical press. The trade press, he pointed out, can and is eager to put before the trade interesting news of the jobbers' activities.

At the afternoon session M. C. Turpin of the Westinghouse Merchandising Bureau and J. A. Corcoran of the General Electric Company spoke on electrical merchandising. E. B. Seitz, secretary of the American Association of Washing Machine Manufacturers, on Friday morning told the jobbers how the washing-machine men are co-operating with the United States government's agents in educating women in the use of the electric washing machine.

The spring meeting of the association has been set for May 25, 26 and 27 at Hot Springs, Va.

Kansas to Hold Water-Power Congress

A WATER-POWER congress, to be held in the State House at Topeka, Kan., Dec. 15, has been called by Governor Allen. The congress is called to agree upon and adopt a state policy with reference to the investigation and use of water resources and the effect of such a policy on state activities.

Transmission Line at 220,000 Volts Planned for Sweden

TO UNITE the hydro-electric resources on the eastern and western sides of Sweden and make their output more extensively available the Swedish government has decided to construct a 220,000-volt line between the super-power plants at Trollhättan and Alfkarleby. The plans are to have the line completed by December, 1921. While the line will be constructed for the voltage mentioned, it will be initially insulated for 132,000 volts and rated at about 30,000 kw. Later, when the water powers to the north must be utilized, the voltage, and hence the rating, will be increased.

Commissioner Edgerton Defends California Railroad Commission

DECLARING that criticism of the California Railroad Commission is usually based on misstatements of a fact or a purpose, Edwin O. Edgerton, president of the commission, in an address made before a meeting of the League of California Municipalities at Chico recently, told the representatives of California towns and cities present that they owed it to their constituents to inform themselves fully as to public utility matters.

It must be clearly understood, Mr. Edgerton said, that if California is to progress industrially there must be an immense increase in the facilities of the companies performing public utility service. Expressed in terms of money, this will mean several hundred million dollars in the next few years. It must be admitted that there is no power to force investment in the securities of these companies, and sound policy becomes of vital importance as an assurance to the investor.

United States Chamber of Commerce to Hold Street-Railway Referendum

A REFERENDUM vote of its membership is being taken by the United States Chamber of Commerce on proposals for bringing about an improvement in the situation of the street railways of the country. The recommendations on which the ballot will be cast have been advanced by the Chamber's committee on public utilities. They are eight in number and read:

1. Existing traction facilities should be conserved.
2. The attitude now taken toward street-railway problems should be based upon the present and future needs of the community.
3. The attitude which is taken toward street-railway problems should contemplate private ownership and operation.
4. Regulation should everywhere be instituted that will promptly follow changes in the situation of the companies rendering services of local transportation.
5. Provision should be made against the consequences of unfair competition.
6. All burdens unrelated to the service performed should be removed from street railways.
7. Official responsibility should be definitely fixed for the application of regulation.
8. Each company should seek to have available for the public at all times the facts as to the results of operation and should have resident responsible executives wholly conversant with local requirements.

A summary of the committee's report accompanying the referendum ballots deprecates opposition to fair treatment of the railways because of alleged past mismanagement and dwells on the need of adequate revenues if good service is to be performed. Prompt and flexible regulation is advocated.

Readjustment Without Panic Is Predicted by Archer W. Douglas

POST-WAR readjustment finally is at hand with no prospect of financial panic in sight, according to Archer Wall Douglas, chairman of the committee on statistics of the Chamber of Commerce of the United States, whose monthly report on business conditions has just been made public. The course of prices, the report sets forth, will continue downward. Merchandise stocks by Jan. 1 will be smaller than for many years.

"Demand in all lines is slackening," Mr. Douglas says. "It is everywhere a case of most conservative buying rather than any great increase in supply. Manufacturing and mining are meeting the situation, in the usual fashion, by running on reduced time or shutting down altogether. This has already meant in some cases reduced wages. Talk of stabilizing prices to save the situation no longer interests any one save a few hopeless theorists. The laws of supply and demand will regulate matters. Industrial life in time will doubtless be more democratized than at present, but we are not headed in the direction of running factories by committees."

Power Company Wins Right to Supply Bulk Energy in Competitive Territory

AGAINST the protest of the Webster & Southbridge Gas & Electric Company, the New England Power Company has been authorized by the Massachusetts Department of Public Utilities to supply energy in bulk to the Slater Mills, in Webster, and to transmit energy over certain public ways in Webster and Oxford. The former company objected on the ground that it is meeting the requirements of the community which it serves. The decision is important in relation to the policy of the state in permitting energy to be supplied in bulk in competitive territory. This is the first case in which a local company, willing that the New England Power Company should pass through its territory, has contended that the larger company should be altogether and permanently excluded from doing business in the local company's territory.

The commission holds that the Legislature has never expressly granted to any electric company the monopoly of the business in a specific territory. The entry of a second company is left to the judgment of the commission and the issue is to be decided with regard to its broad effect upon the public welfare. It is held that the supply of electricity in bulk in most instances can be accomplished without the evils incident to unrestricted competition and multiplication of lines.

Westinghouse Stockholders Authorize Increased Capitalization

AT A SPECIAL meeting of the stockholders of the Westinghouse Electric & Manufacturing Company held on Nov. 18 at East Pittsburgh an increase in the indebtedness of the company by the sum of $30,000,000 was indorsed. This is the official authorization of the ten-year 7 per cent bond issue which was offered to investors last month.

The stockholders at this meeting voted also to authorize an increase in the capital stock of the company from $75,000,000 to $125,000,000. It is understood that no new stock will be issued at this time.

Federal Power Commission Activities

THE first rulings of the Federal Power Commission on the "declaration of intention" provided for in the water-power act were made at the regular meeting of the commission on Nov. 22. It was ruled that a proposed development at Ada, Mich., on the Thornapple River, would affect the interests of interstate or foreign commerce and that the commission would have jurisdiction in passing upon the project. A declaration of intention was filed by the Peshtigo Pulp & Paper Company for a proposed development 7 miles below Peshtigo, Wis., on the Peshtigo River. The commission found that the project did not affect the interests of interstate or foreign commerce.

The chief counsel of the commission was instructed to investigate the legal situation with reference to the use of water power developed by the withdrawal of water from Niagara River above the falls. The chief counsel was instructed also to take up the question of the jurisdiction of the Federal Power Commission where power development is incidental to irrigation.

It is understood that the Niagara Falls Power Company is practically ready to submit its statements covering the valuation of its property. It also is understood that the Utah Power & Light Company soon will submit a valuation statement. So far as is known, no valuations of these properties have ever been made by any public authority. In the case of the Niagara Falls Power Company the matter of valuation is complicated by the maintenance of a plant in standby condition. Since the checking of valuations is an expensive undertaking, the commission must receive a new appropriation before such work can be undertaken.

Pennsylvania-Ohio Company Segregates Railway and Power Property

THE Public Utilities Commission of Ohio has authorized the purchase by the Pennsylvania-Ohio Power & Light Company of part of the properties of the Pennsylvania-Ohio Electric Company, Youngstown, Ohio. The properties included in this purchase are the street-railway lines in and around Sharon, Pa., the interurban line from Sharon to Youngstown, Ohio, and all light and power properties of the Pennsylvania-Ohio Electric Company, except that in New Castle, Pa. The railway properties involved comprise, in earning power, about 10 per cent of the street-railway and interurban lines of the Pennsylvania-Ohio Electric Company.

In accordance with the order the old company has sold its light and power and a portion of its street-railway holdings for $13,297,950 cash, $1,800,000 8 per cent preferred stock and $6,000,000 common stock of the Pennsylvania-Ohio Power & Light Company. Ownership passed to the new company on Nov. 1.

New Officers for the Southeastern Section, N. E. L. A.

THE new officers elected at the close of the convention of the Southeastern Section of the National Electric Light Association, held at Miami, Fla., Nov. 16 to 19, are as follows: President, S. B. Ireland, vice-president and general manager Montgomery (Ala.) Light & Water Power Company; first vice-president, J. M. Cheney, secretary and treasurer Orlando (Fla.) Water & Light Company; second vice-president, F. D. Mahoney, commercial manager Alabama Power Company; third vice-president, George E. Watts, Southern sales manager, Locke Insulator Manufacturing Company, Atlanta, Ga.

On the executive committee a representative from each of the states which the Southeastern Section comprises was appointed as well as two representatives of manufacturers. The membership includes: R. L. Lindsey, Durham, N. C.; H. A. Orr, Anderson, S. C.; C. D. Flanegan, Athens, Ga.; L. L. Newman, Birmingham, Ala.; F. E. Fletcher, Tampa, Fla.; H. A. Coles, Atlanta, Ga.; E. H. Grim, Atlanta, Ga., and P. A. Tillery, ex officio.

This year an elaborate entertainment program was carried out under the direction of H. H. Hyman, general manager of the Miami Electric Light & Power Company. One of the enjoyable features was a six-hour sail from Miami to Bimini Island, one of the British Bahamas, where the annual banquet was held on Thursday evening, Nov. 18.

Montana's First Electrical Show

THE results of the first electrical show ever held in Montana are showing up in the sales of all kinds of electrical appliances in Butte. The show was held Oct. 4 to 8 in the Butte offices of the Montana Power Company, which was the sponsor for the affair. About 15,000 people visited the exhibit and demonstrations. Publicity was given by means of newspaper advertising in the local papers and by folders mailed to the consumers of the power company. Local supply jobbers and dealers co-operated by placing their specialties in the exhibit and supplying demonstrators. It is planned to make the show an annual event.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Vancouver, B. C., Has an Electrical Show.—The first electrical show ever held in Vancouver, B. C., took place this week under the auspices of the newly formed British Columbia Electrical Cooperative Association.

Electricity in Ocean Propulsion.—What is said to be the first electrically driven ocean-going cargo vessel under private operation, the Eclipse, left New York recently for the Dutch East Indies with general cargo. It is a Shipping Board vessel of 11,800 tons, operated by the United American Steamship lines.

New Central Maine Issue.—The Central Maine Power Company has been authorized by the Maine Public Utilities Commission to sell at not less than $107.50 per share and accrued interest not more than 24,315 shares of 7 per cent preferred stock to meet the cost of improvements and consolidations and furnish working capital.

Memphis Advances Rates.—The following schedule of advanced electric rates has been announced by the Memphis Gas & Electric Company under authority of the Tennessee Public Utilities Commission. First 50 kw.-hr. a month, 9 cents per kilowatt-hour; next 150 kw.-hr., 7 cents; next 300 kw.-hr., 6 cents; next 500 kw.-hr., 5 cents; more than 1,000 kw.-hr., 4 cents; minimum bill, 90 cents a month.

Toronto Rates Go Up.—Increases of rates ranging from 11 to 35 per cent are announced by the Toronto & Niagara Power Company, formerly the Toronto Electric Light Company, to become effective Dec. 1. Higher labor costs, increased costs of materials, higher taxes and workmen's compensation rates are the reasons given by the company for the increase. The Hydro-Electric Commission of Toronto has not taken on any new customers for some time owing to the existing shortage of power.

Maritime Province Power Developments.—It has been decided by the Electric Power Commission of the Province of New Brunswick, Canada, to proceed at once with the development of the water power afforded by the Musquash River, which empties into the Bay of Fundy. Three generators rated at 2,700 kva. and driven by 3,200-hp. turbines will be installed in a power house to be erected near St. John, the chief city of the province. In the neighboring Province of Nova Scotia the hydro-electric plant under way on St. Margaret's Bay, 15 miles from Halifax, is well on toward completion.

Hydro-Electric Power in the Dordogne Basin.—A concession has been granted by the French government to the Orleans railroad for exploiting the water powers in the basin of the Dordogne. In *Le Génie Civil* an estimate of the horsepower capable of development in this region is made by G. Tochon, who puts it at 1,400,000 during the flood periods in the spring and fall. At present only about 7 per cent of this potential power is utilized, though plans under consideration call for the development of about 585,000 hp. A saving of 3,000,000 tons of coal a year by the electrification of railroads is one of the advantages kept in view by the government and the promoters of the project.

Speeding Up Canalboat Loading.—Just one-quarter of the time formerly taken to load or unload a canalboat lying at an East River pier in New York is required since the recent installation of electrically driven overhead wharf cranes, according to the *Edison Monthly*. The former method of handling the cargo was by hand with the aid of a whip boom, block and tackle and a horse. With one crane and two men in the hold of a barge, it is now possible to unload in one day 175 tons of miscellaneous freight. At the pier in question two barges may be loaded or unloaded at once by the use of two cranes, or by using one crane at the forward and another at the after hatch one boat can be unloaded in double-quick time. The cranes are equipped with 220-volt direct current Shaw motors, the hook hoist and rack motors are of 18 hp. and the boom and travel motors of 8 hp. The hoist and rack have a speed when carrying a full load of 125 ft. a minute, and in moving the boom from a horizontal to a vertical position the rate of travel is 100 ft. a minute.

A Remarkable Scheme for Domestic Generation of Electricity.—A French scientist, E. Colardeau, has, according to a press dispatch, expounded before the French Academy of Sciences a plan by which he is said to hold that every family in Paris could generate electrical energy without expense and in useful quantities. The plan is based on utilization of the power from the water supply. In his own house, the inventor is reported as saying, he has fixed on his supply pipe a high-speed water turbine, connected to a dynamo, with a little battery of accumulators. Every time that the taps are turned on the little generating station works and the batteries accumulate the energy from the water. With his own installation the scientist claims he can light one 500-cp. lamp or twenty lamps of from 15 cp. to 20 cp. In his house he uses no other installation and it never gives out and never costs him anything. In the country places M. Colardeau would use the wind to pump water up to the required height and so transfer the wind energy into water energy, which in turn would be transferred into electrical energy in the manner already described.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Engineers' Club of Philadelphia.—At a meeting of this club on Dec. 3 a discussion will take place on the use of powdered anthracite and the recovery and use of "river coal."

St. Louis Electrical Board of Trade.—It was announced at the meeting of this body on Nov. 9 by President C. E. Michel that a series of talks dealing with standardization had been arranged. I. P. Kelso presided at the meeting.

Indianapolis-Lafayette Section, A. I. E. E.—The first meeting of this section was held recently in the University Club at Indianapolis, when the following officers were elected: Chairman, L. Lloyd Wayne; secretary, D. C. Pyke; vice-chairman, Prof. C. F. Harding; chairman of the membership committee, D. J. Angus; local membership, M. J. Luichinger. Meetings will be held on the third Friday evening of each month.

American Physical Society.—Among the papers presented at the 150th regular meeting of the American Physical Society, held at Cleveland on Friday and Saturday of this week, were the following: "Conductivity of Insulating Materials Near the Breakdown Voltage," by J. E. Shrader, Westinghouse Research Laboratory, and "The Magnetic Mechanical Analysis of Manganese Steel," by Sir Robert Hadfield, F. R. S., London, and S. R. Williams and I. S. Bowen, Oberlin College. Other papers dealt with the Nernst effect, the vaporization of tungsten, electrostatic measurements, electromagnetic induction, thermionic discharges in evacuated tungsten lamps and the electromagnetic theory applied to the Copernican atom.

Coming Meetings of Electrical and Other Technical Societies

Indiana State Electrical Contractors and Dealers' Association—South Bend, Dec. 1 and 2.

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—Joint meeting, New York, Dec. 3.

Association of Iron and Steel Electrical Engineers—Philadelphia Section, Dec. 4; Chicago Section, Dec. 11; Cleveland Section, Dec. 13.

Rivers and Harbors Congress—Washington Dec. 8-10.

Illinois State Electric Association—Chicago, Dec. 9. (For program see issue of Nov. 6, page 942).

A. I. E. E. and A. S. M. E.—Philadelphia Sections, joint meeting, Philadelphia, Dec. 13.

American Physical Society—Annual meeting, Chicago, Dec. 28-Jan. 1.

American Institute of Electrical Engineers—Chicago, Jan. 14.

Western Association of Electrical Inspectors—Detroit, Jan. 25-27.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 27 and 28.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

What Constitutes Confiscatory Rates.—Rates of an electric company, the Illinois Public Utilities Commission asserts, cannot be said to be confiscatory where they are only very slightly lower than the rates which, upon the utility's own showing, have yielded a return of 12 to 13 per cent upon the rate base, besides a fair allowance for depreciation.

Customers' Rights Superior to Company's.—In adjudicating a water company's petition for increased rates the Maine Public Utilities Commission declared that if it becomes a question whether a utility shall receive an adequate return or the rates shall be reasonable and just to the customer the company must yield to the superior rights of the customer.

Efficient Operation.—An exhibit showing the average amount of coal burned to generate a kilowatt-hour to have been 11.8 lb. in 1918 and 11.19 in 1919 indicates inefficient central-station operation, in the opinion of the Illinois Public Utilities Commission, which believes that a coal consumption of less than 7 lb. per kilowatt-hour should be attained in a plant serving a city of 11,000 population and contiguous places.

Rules Governing Service by Municipal Plant.—Entertaining a complaint against the rates for electricity charged by the town of Kennebunk, the Maine Public Utilities Commission declared that a municipal plant should be operated on a safe basis but without profit. A municipality which operates its own electric light plant and charges for street lighting an amount less than the cost of rendering that service is guilty of illegal discrimination, since it follows that the other customers of the company are paying a part of the bill for street lighting.

Fixing Amount of Minimum Bills.—The Illinois Public Utilities Commission has permitted the Centralia Gas & Electric Company to increase its minimum bill to $1 per meter per month, the evidence showing that the operating expense incident to furnishing the service was 84 cents per consumer per month, to which must be added an amount to care for depreciation, uncollectible bills, interest and taxes on the investment necessary to serve the customer. Irrespective of how much cash a company may have on hand, it is proper, the commission says, to permit it to earn a fair rate of return on a reasonable amount of cash working capital.

Court Receivership Does Not Abrogate Commission Control.—In granting increased rates to the Commonwealth Public Service Company the Arkansas Corporation Commission asserted that it had jurisdiction of the property and the rates to be charged for service even though the property was being operated temporarily by a receiver under court direction. The financial adversities which forced the company into the receivership could not, the commission said, remove it from operation of the statute and the jurisdiction of the commission so long as the company continued to exercise its functions in any capacity.

Need for Adequate Working Capital.—Quoting a declaration of the Supreme Court of the state that what a public service company is entitled to ask is a fair return upon the value of that which it employs for the public convenience, the Georgia Railroad Commission adverts to the need of adequate working capital. "We are not suggesting here," it says, "a separate valuation of what is commonly called 'going concern' value, as a distinctive item, or that other thing called 'good will' which may go with properties devoted to certain uses, but solely that added value in the physical properties themselves attaching because of their assembly, unification, adaptation and utilization in the purposes for which, as a whole, they were designed. In the proper functioning and operation of these physical properties there is need of a cash working fund, with which, pending the collection of its revenues, necessary supplies may be purchased and kept in stock for use as needed, and out of which payrolls may be met."

The Utah Commission's Ruling on Special Contracts.—In asserting its power to modify or change rates, charges, facilities and conditions of service in existing contracts with the Utah Power & Light Company for electric service (see ELECTRICAL WORLD, Oct. 23, page 843, and Nov. 6, page 909), the Public Utilities Commission of Utah said: "The contention of the companies holding special contracts that they come under the exception clause has been ably presented, but it appears to the commission that it is in line with the spirit of the law in concluding that such an exception does not and was not intended to prevent an investigation such as is undertaken in this case. If the rates in special contracts, such as those now under consideration, were to be made special matter of legislative enactment and relieved from any investigation, with a view of protecting and perpetuating such rates, as is claimed by the contract consumers, it would seem that a matter of such importance would have received the direct attention of the Legislature in such a manner as to place the subject beyond any question as to what was intended. . . . We find no warrant," the commission declared, "for accepting the theory that such action was taken or intended to be taken by the Legislature."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Commission's Power to Change Franchise Rates Not Unconstitutional.—In a suit brought by the city of Camden, Ark., against the Arkansas Light & Power Company the act establishing the Corporation Commission of the state was attacked as unconstitutional. The Arkansas Supreme Court found that the contention was without force inasmuch as the power conferred on the commission was an exercise of the state's police power, which cannot be contracted away, and therefore that the act is not invalid as impairing the obligations of a contract in contravention of the United States Constitution. (224 S. W. 444.)*

Delegated Authority and Commission Regulation.—In City of Sapulpa vs. Oklahoma Natural Gas Company the city contended that in the Territorial days of Oklahoma the United States delegated to Sapulpa authority to regulate service and fix rates and that said authority could not have been set aside by the United States prior to the adoption of the state constitution and could not now be set aside by the state. The Supreme Court of Oklahoma held that, the contract not being for a definite period, the United States prior to statehood could through Congress have revoked the authority and that upon Oklahoma becoming a state this power passed to the Legislature of the state. (192 Pac. 224.)

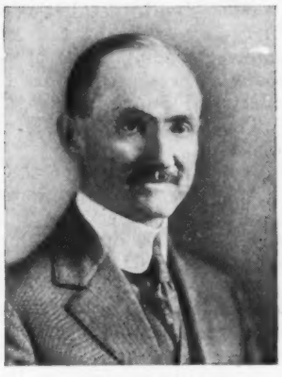
Dams That Do Not Interfere With Navigation Are Not Nuisances per se.—The construction of a power dam across a navigable river is not a nuisance *per se*, according to the finding of the Supreme Court of Wisconsin in Eau Claire Dells Improvement Company vs. City of Eau Claire, where all attempted navigation of the river is in fact carried over the dam, so that its navigability is not materially affected and no person suffers damage thereby. Where a city which had leased to a corporation the dam and surplus water power over that needed for the city's waterworks had afterward acquiesced in the building of a mill over the lock required to be maintained by the lease and had not only agreed but required that lessee maintain flashboards raising the water above the specified height, it was estopped to declare a forfeiture of the lease for those violations of its terms after they had continued for a period of more than twenty years. (179 N. W. 2.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

James A. Perry, elected president of the National Association of Railway and Utility Commissioners for the coming year, is a man whose past actions prove that he will exert himself to the utmost to strengthen the prestige of the state regulatory bodies. He strongly opposes any curtailment of their powers at the hands either of the federal government or of the municipalities. He has long been active in the work of the association and prior to his election as president occupied the office of vice-president. Mr. Perry for ten years past has been a member of the Railroad Commission of Georgia. He has done much to build up that body and to place its operations on a basis of efficiency. As a member of the commission he has



J. A. PERRY

had a voice in deciding many important questions affecting the utilities of the state. He was born in Gwinnett County, Ga., in 1875, and obtained his early education in the rural school of that county. He was graduated from the law school of the University of Georgia in 1898. Two years thereafter he was elected mayor of Lawrenceville, Ga., and later in the same year was elected to the State Legislature. In addition to his public duties, Mr. Perry conducted a law practice in Lawrenceville. He is now president and treasurer of one of the largest industrial companies in Lawrenceville, operating a cottonseed-oil mill and a guano plant.

Dr. Joseph F. Merrill, who as chairman of the Utah Section of the A. I. E. E. is building up a marked interest in Institute work in that section, is dean of the engineering college at the University of Utah and widely known in electrical engineering circles. Dr. Merrill was born at Richmond, Utah, Aug. 24, 1868. He received the degree of B. S. from the University of Michigan in 1893 and that of Ph.D. from Johns Hopkins in 1899. His first teaching experience was as assistant professor of chemistry at the University of Utah in 1897. He became director of the Utah State School of Mines and Engineering at the University of Utah in 1898 and professor of physics and electrical engineering at that institution in 1899. Dr. Merrill has contributed largely to the electrical engineering profession through extensive research work, which includes investigation of the effect of dielectrics on electrical resistance, effect of temperature and pressure on electrolysis of silver nitrate and of the reliability and durability of commercial electric integrating meters.

Harry D. Stokes, power engineer Worcester (Mass.) Electric Light Company, has been elected chairman of the Worcester Electrical Contractor-Dealers' Association.

H. H. Koelbel, superintendent of sales for the Consumers' Power Company in the Muskegon district, has recently been appointed secretary of the Century Club, the city's business men's club.

Dr. William H. Walker, director of the division of industrial co-operation and research, Massachusetts Institute of Technology, has resigned to enter private practice in chemical engineering. He will be succeeded by Prof. Charles L. Norton of the institute.

O. O. Alenderfer, formerly in charge of commercial sales of the Rogue River division of the California-Oregon Power Company, has resigned and entered into partnership with A. B. Cunningham in the firm of the People's Electric Store at Medford.

R. A. Schuyler has been appointed manager of the Bozeman branch office of the Montana Power Company. He was formerly foreman of the Great Falls plant and has been with the Montana Power Company in various positions since 1912.

D. B. Rushmore, chief engineer of the power and mining department of the General Electric Company, recently returned from Europe, where he has spent some five months investigating trade and industrial conditions. Mr. Rushmore visited the war-devastated sections of Europe and also went to Germany, and reports marked progress in the re-establishing of trade activities.

Percy C. Henry has been appointed superintendent of distribution, New England Power Company, succeeding F. J. Sill, resigned. Mr. Henry is a graduate of Purdue University, electrical engineering department. After service with the Indiana Steel Company at Gary, he became electrical superintendent of the Aluminum Company of America, with headquarters at Massena, N. Y.

Fred M. Abbott, who has been special investigator and safety inspector for the Public Utilities Commission of Utah for the last three years, has tendered his resignation. Mr. Abbott, in addition to his investigating work, has had charge of general safety conditions.

William V. King has been chosen to fill the position of chief accountant of the Federal Power Commission. Inasmuch as a most intricate system of accounting is required for projects under the water-power act, the greatest difficulty was experienced in finding an accountant with the experience necessary to qualify him to work out a suitable system. It is believed that Mr. King will meet all the requirements, since his long experience with Interstate

Edmonston, Washington, D. C.

W. V. KING

Commerce Commission accounting has familiarized him with many of the fundamentals which must enter into the Federal Power Commission's accounting system.

Obituary

Adam Shoop Carr, manager of the Philadelphia office of the Robbins & Myers Company, Springfield, Ohio, died Oct. 13, from typhoid fever.

Charles Ernest Acker, an electrochemical engineer, who built the plant of the Acker Process Company at Niagara Falls and was known as the originator of processes for the manufacture of tetrachloride of tin and carbon tetrachloride, died at his home in Ossining, N. Y., on Oct. 18, in his fifty-second year. Mr. Acker was for several years a practicing electrical engineer in Chicago.

C. B. Kidder, general manager of the Otter Tail Power Company of Fergus Falls, Minn., died on Sept. 20 as the result of electric burns. Mr. Kidder became associated with the Otter Tail Power Company about ten years ago and helped to develop its system of high-tension transmission lines now radiating from Fergus Falls.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Standard Lamp Voltages to Reduce List of Stock Items

LAMP manufacturers are now making a decided effort to standardize service voltage at 110, 115 and 120 volts in order to reduce the long list of stock items and the consequently heavy inventories. When the carbon lamp was most used it was necessary to have different service voltages so as to use up the lamps that were produced. It was not possible to foretell accurately what the voltage of a carbon lamp would be.

This condition has changed, however, and manufacturers have had no difficulty rating type-B lamps before production. Some of the larger central stations were of the opinion that the type-C lamp could not be so accurately gaged, and it was not until recently that they became convinced that the type-C lamp could be produced with the same high accuracy. These utilities have as a result withdrawn their objection to standard-service voltages and the manufacturers are encouraging complete adoption.

This is not a new activity on the part of the lamp manufacturers. They have been studying and analyzing the situation for some time. It was not until these objections were withdrawn, however, that all of the manufacturers felt they were in a position to push these standards.

Farm-Light Producer Builds Up Plant Sales

IN ORDER to build sales of farm-lighting plants, one manufacturer in Michigan, the Automatic Light Company, Inc., has worked out a plan to obtain new dealers and to "liven up" old ones.

Starting on the basis that only 7 per cent of the farmers of the country have electric light, that the farmers are "sold" on electric light and power, and that they have the money and will listen to salesmen who have confidence in their goods and in themselves, this company has equipped three light sedan automobiles with a plant where the rear seat should be and sent the salesmen out in comfort to demonstrate. The results in two months have been beyond fondest expectations, for not only have sales per week increased but the trail of live and interested "prospects" is reported very satisfactory. The first step, however, was to reduce the price of the set. The Main Electric Company of Cleveland has also reported a scale of prices which became effective Oct. 15, showing reductions on all generating sets of about 12 per cent.

In the Middle West sales are reported to have been off in the last few weeks because of a break in grain prices. However, the demand has returned, and increased activity is now reported in this line.

Jobbers' Costs of Handling Twelve Principal Lines

THE accompanying tables give in detail the results of the preliminary thirty-day study of the expense of handling each of twelve principal lines of goods distributed by electrical jobbers, as presented before the Cleveland convention of the Electrical Supply Jobbers' Association on Nov. 17, by H. F. Thomas of St. Paul, Minn., chairman of the committee on costs.

The figures are based upon an analysis of the business during one month (April, 1920) of four representative jobbing houses in different parts of the country. The four houses studied did together $1,400,000 of sales during that month, with a total expense of $162,000, indicating the average ratio of total expense to total sales to be about 11.6 per cent. The twelve lines reported on in the tables constituted about one-half of the total sales of these four jobbing houses.

In computing the figures neither interest on investment nor income or excess profits taxes was included. The ratios of the separate elements of cost making up the total expense for each line were analyzed, and the figures show the percentage of "financial" expense (accounting, billing, collection and credit expense), warehouse expense and sales expense for each line studied.

While the figures shown cover only a thirty-day period, the results obtained were presented before the convention at this time to illustrate the methods employed and to invite suggestions and criticisms concerning future work of the same kind in other jobbing houses, covering all lines and extending over a longer period.

Hearty appreciation of the scientific cost studies made by Mr. Thomas' committee was evident on the part of the jobbers and an additional fund of $10,000 has been voted the committee to extend the studies to cover all lines handled by six different jobbing houses, the study to extend over six months.

It is expected that the figures for the first three months of this new survey will be ready for reporting before the Jobbers' Association spring meeting, scheduled for Hot Springs, Va., in May.

WHAT IT COSTS JOBBERS TO HANDLE TWELVE LINES

Lines Reported	Amount of Sales, Four Jobbing Houses, Month of April, 1920				"Financial" Expense		Sales Expense		Warehouse Expense		Total Expense	
	Warehouse	Delivered	Direct Sales	Total Sales	Amount	Percentage of Sales	Amount	Percentage of Sales	Amount	Percentage of Sales	Amount	Percentage of Sales
Schedule material	$48,098.82	$7,879.74	$14,223.18	$70,201.74	$3,192.80	4.42	$5,047.94	6.96	$4,402.34	7.68	$12,643.08	17.07
Rubber-covered wire and lamp cord	61,736.06	7,430.86	24,893.53	94,060.45	1,567.59	1.62	3,120.68	3.36	2,421.21	3.56	7,109.48	7.67
Rigid conduit, elbows, bushings, etc	40,689.33	4,308.75	5,904.94	50,903.02	1,071.83	2.14	2,379.78	4.87	2,599.61	5.68	6,051.22	12.25
Porcelain knobs, cleats and tubes	10,382.96	825.48	465.43	11,673.87	387.48	3.42	1,367.79	13.13	1,073.52	7.72	2,828.79	27.15
Weatherproof wire	52,094.98	2,335.03	40,682.65	95,112.66	981.59	0.96	1,965.88	2.62	1,006.86	2.03	3,954.33	4.93
Conduletes or similar fittings	15,840.84	2,984.69	1,153.33	19,978.86	1,305.18	6.98	1,701.36	8.56	1,641.86	9.15	4,648.40	24.03
Flashlights and flashlight batteries	4,710.41	1,202.02	1,951.38	7,863.81	550.15	7.62	929.95	11.10	702.31	10.66	2,182.41	28.71
House goods (bells, push-buttons, etc	1,347.29	502.80	529.69	2,379.78	198.64	9.24	474.63	14.09	262.23	16.58	935.50	37.93
Dry batteries	10,739.82	933.39	935.12	12,608.33	266.99	2.22	983.69	8.72	615.40	5.84	1,866.08	16.33
Heating devices	23,554.63	3,074.59	6,835.08	33,464.30	1,078.89	3.06	2,810.17	7.81	1,797.05	6.79	5,686.11	16.44
Commercial fixtures	10,926.28	928.93	2,668.67	14,523.88	380.01	2.77	1,555.78	10.49	961.96	7.58	2,897.75	19.48
Pole-line hardware	13,666.96	2,020.34	18,538.57	34,225.87	873.22	2.96	3,254.82	8.10	2,423.43	7.71	6,551.52	19.79

New York Jobbers See Bright Side to Present Trade Conditions

IT IS EVIDENT that the disquieting situation affecting electrical supply jobbers in New York territory is not so bad as has been painted, despite reports of excess stocks, decreasing demand, cancellation of orders and cutting of prices.

It was pointed out by several representative houses that the present level of demand and of inventories, instead of being considered in the light of the banner year 1919, do not shape up unfavorably when compared with a normal average period of business. A recession in sales is to be expected following a peak year of business, and growing stocks, it is said, are noticed especially at present, following the shortage heretofore existent in many lines. Too much concern, it is admitted, has been expressed regarding the cancellations, prices and surplus stocks of competitors. This, it seems, has led to a more pessimistic outlook on present conditions than the situation warrants. Taken individually, almost every jobber in the metropolitan territory personally disclaims being hard hit by adverse conditions, while admitting their prevalence with competitors. Therefore it would seem a wise policy in the trade at present to stop crying "Wolf! Wolf!" and to concentrate efforts upon pushing one's own business.

It is understood that in the slack season of 1907 a well-known electrical jobber, instead of following the example of competitors and releasing salesmen wherever possible, made capital out of the pessimism of others by taking on several additional excellent salesmen who had been let go. With this augmented force the house in question showed a larger volume of sales for 1907 than any previous season. A similar policy is being successfully followed by a representative jobber in New York at the present time. This firm has recently taken on six new salesmen and is pushing sales harder than ever before. As a result, it is said, orders for the month of October reached a larger total than in any previous month this year except one, and November sales thus far bid fair to outstrip those of October. It is difficult to trace the ultimate destination of this business at present, but the fact of its existence is indisputable. Several other jobbing houses that report inventories at a favorable level, few cancellations and little resort to price cutting to move goods state that increased sales efforts are responsible.

Flexible-Armored-Conductor Market Is Weak

TWO or three months ago, it is safe to say, the shortage of flexible armored conductor was acute in most sections of the country. At present the general condition with respect to this commodity is a glut in the market. Several reasons are advanced for this complete reversal of form. Probably the chief one has been the removal of embargoes which previously prevented manufacturers both from receiving material and from shipping the finished product. As a result, when restrictions were suddenly lifted producers flooded the market with cable to such an extent that demand was not only satiated but stocks grew too large. And about this time consumer demand on the part of building construction began to slump. Furthermore, raw-material difficulties that had been existent, such as the dearth of steel strip, then began to be relieved. Today manufacturers of steel strip are able to ship carload lots in a week to ten days' time. Deliveries of finished cable can also be made almost immediately, ranging up to two weeks' time.

During the period of a weakening market prices performed queer stunts as the result of jobbers' efforts to keep down inventories. Manufacturers, however, did not follow suit with price cuts as stocks of high-priced material prevented any decline. Many cancellations and requests for extensions of time resulted. So far as can be learned some manufacturers quite recently were still holding to their old price levels, though others have now reduced their quotations.

Reports are current that No. 14 two-wire, double-strip cable can be purchased as low as $75 per 1,000 ft., which is considerably below the quotations of most manufacturers, whose prices for the size mentioned range from about $78 to $85 per 1,000 ft. On the other hand, some jobbers in the East are quoting as high as close to $100 per 1,000 ft. for No. 14 and report fairly good sales at that figure. These instances appear to be isolated cases of exceptional activity in the house-wiring field, however.

Manufacturers in general appear to be optimistic regarding the return of the building industry and consequent good demand for cable next year. At least they are going steadily ahead with production. Factory stocks as yet are not large, especially in the larger size of cable, which has been in greater demand from industries.

Linemen's Tools Becoming Available

JOBBERS and others who have been discouraged by their inability to get linemen's tools except on deliveries of from twelve to eighteen months will be able to get pliers in sixty to ninety days by January or February of next year, according to the estimate of one of the foremost manufacturers of this line. The war cut off the foreign supply of these tools, and the necessary skilled labor became so scarce that up to a few months ago the manufacturers of linemen's tools were getting further and further behind with their orders.

Pyramided orders have been canceled and all the needed labor and material have been obtained, so that the delivery not only on pliers but on connectors, climbers, etc., is being gradually reduced. This is especially true of climbers, which are intermittently obtainable from manufacturers' stocks.

The Metal Market Situation

LITTLE change is evident in the copper market, except that the attitude of "watchful waiting" on the part of both producers and consumers is perhaps a bit more pronounced. Certainly large buying orders remain as much lacking as ever. Further wage cuts and reductions of output are announced, the latter in an effort to reduce the large surplus stocks of copper known to exist in the country.

Producing interests show little desire to sell at the figures offered by consumers. Large operators are asking 14.75 cents for copper delivered over the remainder of this year and 15 cents delivered covering the first quarter of next year. Some shading of these prices by small producers is rumored. In the outside market 14.25 cents delivered is asked for prompt shipment, and 14.75 cents over the first three months of 1921. Foreign demand remains very weak.

In view of recent developments in the iron and steel market the statement of Judge Elbert H. Gary, chairman of the board of the United States Steel Corporation, issued last week, to the effect that there will be no change at this time in base selling prices of products handled by the corporation, is interesting. The base selling prices quoted at present by the corporation are those which were mutually suggested at a meeting of iron and steel interests with representatives of the United States government in March, 1919.

NEW YORK METAL MARKET PRICES

	—November 15—	—November 22—
Copper	£ s d	£ s d
London, standard spot	85 15 0	78 10 0
	Cents per Pound	Cents per Pound
Prime Lake	Nominal 15.50	Nominal 14.50
Electrolytic	14.75–15.00	14.25–14.75
Casting	14.25	14.00
Wire base	17.00–17.50	16.00–16.50
Lead, trust price	7.00	6.50
Antimony	6.00	5.87½
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	11.50	11.50
Zinc, spot	6.85	6.60
Tin	36.00	36.25
Aluminum, 98 to 99 per cent	32.90	33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	12.00–12.50	12.00–12.50
Brass, heavy	6.00– 6.50	6.00– 6.50
Brass, light	4.50– 5.00	4.50– 5.00
Lead, heavy	5.00– 5.25	5.00– 5.25
Zinc, old scrap	3.75– 4.00	3.75– 4.00

THE WEEK
IN TRADE

A LITTLE better tone is apparent in the jobbing trade this week. Almost without exception the reports from the different sections of the country show a fair amount of buying, and in some cases better buying than in the recent past. Supplies of electrical materials are being received in good volume, but while some stocks are building up in pretty good shape, in many instances jobbers are keeping down their inventories by expending greater sales effort. The answer to this effort is that stocks are moving.

Building remains at a low rate, as a general thing, although here and there some activity is found. Since the investigations into the housing situation in New York City pronounced reductions in building materials have been reported, some reductions running to 30 per cent. These investigations are digging into alleged combinations in the control of building materials.

Cancellations do not appear to have taken such an active part in the situation as was feared some time ago, and the practice of price cutting is much less serious than was threatened a few weeks back by accumulating stocks and falling off in demand.

NEW YORK

A significant feature of the week is that almost without exception jobbers report a favorable inventory level, and the success of efforts to avoid overstocking is apparently not due to price cutting to any great extent. Cancellations, too, are conspicuous by their absence, and collections for the first time in several weeks are reported better by jobbers.

Though compared with some months ago a depression of trade undoubtedly exists, several jobbers report fairly good sales. Some lines such as wire, tape and armored cable are moving especially slow, but light demand in one line is very often offset by activity on another item.

Although residence construction work is very light, the volume of sales to electrical contractors is good. This is probably due to the large number of industrial and commercial projects that have been under way for a long time and have now reached the stage of electrical work. This is borne out by one of the leading electrical contractors in this section, who says business never has been better than at the present time.

Shipments from the steel-producing district are still irregular. Stocks of rigid conduit, outlet boxes, etc., are consequently spotty, though the first break toward an easier market on pipe is seen

Safety Switches.—In spite of the fact that open switches are reported being gradually superseded by the safety type, demand is not large at present and stocks are held down. Prices remain steady.

Rubber-Covered Wire.—Some jobbers are making good sales despite a general weak market. Stocks are kept at a fairly low level, but prices are all over the lot, No. 14 ranging from $9.50 to $10.50 per 1,000 ft.

Tape.—Demand is weak, but jobbers' stocks are held within reasonable limits. The price of friction and rubber ranges all the way from 50 cents to 60 cents a pound on each, in lots of 100 lb.

Schedule Material.—Considerable complaint is heard of porcelain holding up the supply. Pull sockets are plentiful, but not so other types. Although stocks with some are not moving, most jobbers report a fairly good demand. Prices show no change.

Outlet Boxes.—Most stocks are short as sheet steel is holding up the supply. Demand is spotty. In small quantities the discount on black is 20 per cent, and on galvanized from 10 to 15 per cent.

Flexible Armored Conductor.—Jobbers are meeting with success in holding their stocks to a low level in the face of a very weak market. No. 14 two-wire is quoted at from $80 to $85 per 1,000 ft., in 5,000 ft. lots.

Conduit.—Although demand holds up as strongly as ever in some cases and one jobber at least is entirely out of the market, reports are now received that sales have slumped within the past month and that supplies are plentiful. Shipments from the Pittsburgh district remain very bad, however. Large sizes are most scarce. One-half-inch black ranges close to $90 per 1,000 ft., and ½-in. galvanized is quoted at $100 in quantities of 2,500 lb.

Heating Appliances.—Hollow ware is scarce, but other items are plentiful. Demand is fairly strong, but sales do not appear to be so large as was anticipated.

CHICAGO

With remarkable consistency prices in the electrical industry are remaining firm in this territory, and the effect is gradually to establish public confidence in the stability of these goods and to cause a resumption of buying. This tendency is only slightly noticeable so far, but it is significant that in practically every other line dependent on retail trade for support the "buyers' strike" is still in effect and can be temporarily broken only by radical price reductions, while the electrical line, in which no cuts have been made, is feeling a stiffening in demand.

Dealers still feel uncertain as to the volume of Christmas trade and in many instances are understocked. Jobbers, with more confidence in the consuming power of the public, are well supplied and can take care of any reasonable volume of trade. Orders for Christmas tree lights are beginning to come in and bid fair to absorb all stocks.

Lightning Arresters.—Prices are unchanged and demand light, but manufacturers are still behind on orders. Even with present dull business continuing, it will take several months for jobbers to build up any stocks.

Circuit Breakers.—Carbon circuit breakers are obtainable from manufacturers' stock in reasonable numbers, but the oil type are still scarce and from ten to twelve weeks is necessary to secure delivery. Demand has fallen off.

Transformers.—Supply of station transformers is getting better and orders are light. Volume of inquiries holds promise of steady demand for the future. The demand for outside transformers for farmers' use has practicaly ceased, but with the advance of crop marketing should soon again make itself felt.

Farm-Lighting Plants.—Increased activity in this line is general throughout the territory.

Copper Wire.—Copper wire is obtainable at various prices, depending on how badly the holder wants to make the sales. Price ranges as wide as $1.50 are heard of, but the larger interests are holding firm. Demand is only fair, and supply in all but No. 6 triple-braided weatherproof is adequate for present needs.

Cross-Arms.—No price change has as yet occurred, but sales are at a minimum, the trade being apparently waiting for the cut they believe to be inevitable. Coast yards can make immediate shipment in any quantity, and plentiful supplies are in local stocks.

Poles.—The season is ending with an unusually heavy demand well taken care of. Stocks, as usual this time of year, are very low. Indications are for a good labor supply in the woods this winter and ample supplies at perhaps lower figures next year.

Washing Machines.—Retailers report improved sales, the volume of business being directly proportionate to the effort expended. Those districts in which real sales effort is being made are experiencing a handsome return for their work and this is being done in enough places to make the aggregate of orders placed with jobbers have a very encouraging look.

BOSTON

A slight improvement in the market was noted at the close of the week. While many manufacturers and jobbers are busy on back orders some new business is being booked. Contractor-dealers are buying more wiring material and a large amount of old-house wiring and a good deal of central-station line extension work is in progress in New England. Industrial plants are doing considerable rehabilitation and betterment work. The building trades are rather quite but the total building and engineering contracts for New England from Jan. 1 to Nov. 17 amount to $288,171,662, compared with $202,250,000 for the same period last year. A leading jobber reports 91 per cent greater business for October this year than last and is running ahead of last November's business this month. Close attention to collections is yielding better returns on the work of credit departments. General business in New England is largely marking time. Prices are steady in most electrical supply lines except where overstocks force retail cuts.

Wire.—Rubber-covered wire is steady with little demand at $9.50 per 1,000 ft. in 5,000-ft. lots; weatherproof base is 23 cents with no weakness in late quotations, and bare is running on 20 cents base. Magnet wire is still being sold on very long deliveries and so far, prices have not reflected recent reductions in cotton and silk quotations.

Dry Cells.—Current demands are being met with little difficulty. In barrel lots No. 6 dry cells are quoted at $37.50 per 100, and the ignition type at $38.35.

Washing Machines.—Jobbers' stocks are filling up, while trade is a little quieter. So far prices are holding firm.

Lamp Cord.—Plenty of this material is now in hand. No. 18 twisted pair is quoted at $25 to $26 per 1,000 ft. in 1,000-ft. lots, running to about $21 or $22 on 5,000-ft. lots.

Meters.—Shipments are still being allotted to regular customers, and no distribution for central-station stocks is encouraged.

Friction Tape.—Good supplies are in hand, with moderate demand. The ¾-in. black tape is quoted at 57 cents per pound on small lots and at about 54 cents on 100-lb. orders.

Motors.—Stocks are very spotty, and deliveries run into months on most of the leading types and sizes. Widely scattered orders are reported. Prices are firm in the main.

Non-Metallic Flexible Conduit.—A fair amount is being sold. Some jobbers look for a reduction in prices before long, but present quotations are steady. The ⅜-in. size brings $33 per 1,000 ft. in 5,000-ft. lots, and the ½-in. size $36.50.

Rigid Conduit.—Uneven stocks still prevail, but transportation conditions are so much better that little complaint of famine conditions is justified today, even among smaller jobbers.

Flexible Armored Conductor.—This material is moving fairly well, with a healthy demand from contractor-dealers. In 5,000-ft. lots the price is still $85 per 1,000 ft.

Belting.—A reduction in price of from 10 to 15 per cent was made by the Graton & Knight Manufacturing Company, effective Nov. 18, on their leather belting.

ATLANTA

The financing of the Federal Foreign Finance Corporation mentioned last week has got well under way, nearly all of the important banking institutions in this section having subscribed heavily to the stock of the new institution, which is classed as being only second in importance to the Federal Reserve System itself. The view is very generally expressed that the psychological effect of this new organization will be reflected at once in more stable business conditions through the rural districts. The crop report for November shows slight increases in quantity of potatoes and sweet potatoes, a large increase in the peanut yield but a slight decrease in corn, tobacco and apples, the report on the whole showing conditions to be more favorable than last year. When marketed these crops will tend to offset somewhat the low price of cotton, with its consequent poor collections and slack business.

Business, on the whole, is reported slow, retailers and jobbers placing orders with unusual care and for immediate demands only. There have been only isolated instances of the suspension of industrial plants, most of the manufacturing concerns continuing production in anticipation of heavier orders after the first of the year. Most of the textile mills which suspended operation a month ago are getting under way again, while the cotton-oil mills are at last running on nearly normal schedules. This has prevented any general lack of employment, though labor is in greater supply than for some time past.

Heaters.—The sudden cold snap has brought this line again to life, the trade reporting a brisk movement. Retailers are giving especial attention to this specialty and stocks are very good.

Meters.—The shortage continues. Although a large shipment was recently received, it was immediately absorbed by back orders. One of the largest manufacturers reports sufficient orders on hand to absorb the entire output for the next nine to twelve months.

Distributing Transformers.—The demand has eased off somewhat in this line, owing to receipt of heavy shipments in the last few days. These will continue to move well for some time as the supply is still insufficient for all back orders.

Lamp Cord.—Some jobbers are overstocked in this line, while others report shortages. Interchange of stock is the result. Demand holds up fairly well with prices at $25.50 per 1,000 ft.

Fuses.—Renewable fuses continue scarce, and a large number of back orders remain unfilled. The demand continues to hold up well with no change in price. Plug-fuse stocks are in good shape and moving quite satisfactorily.

Washing Machines.—The demand has slowed up all along the line and customers seem to think a reduction in price is in order. Retailers are holding out for heavier discounts and are realizing considerable support from jobbers in this territory. Stocks are heavy.

Ironers.—These do not respond satisfactorily to sales or advertising campaigns, and high prices seem to hold off sales. A few jobbers have rather large stocks on hand.

ST. LOUIS

Jobbers report a satisfactory number of inquiries, but the number of orders placed has not been large. The dull market has not induced pessimism here, inasmuch as electrical men do not expect excessive deflation and feel that they can adjust themselves to a smaller demand during the coming winter. Stocks are large in the staple lines, and in instances where prices have not dropped a healthy deflation of about 10 per cent is expected to be in effect by the first of the year.

Collections are being maintained at about sixty days, but it is requiring more work on the part of the collection departments. The situation is not causing much worry, however.

Wire.—Jobbers have not been able to reduce their large stocks to any extent, but quotations are still on the 23-cent base, No. 14 rubber-covered selling for $9.75 per 1,000 ft. in lots of 5,000 ft. The drop in demand is noticeable, particularly in the size of the orders, as well as their number. Central stations are still buying, but are staying close to their immediate needs. Jobbers report some orders for feeders and for small rural lines.

Rigid Conduit.—While jobbers have much better stocks than was the case a month ago, their reserve stocks, especially in the smaller sizes, are not satisfactory yet. They report a slower demand and are building up their stocks. Shipments from manufacturers are not normal but are much improved.

Linemen's Tools.—Jobbers report no abatement of the long-continued shortage and cannot promise specific delivery in any length of time. Tool manufacturers, however, are reported catching up on orders, and there are hopes that the situation here will improve.

Cross-Arms.—There are good stocks on hand and these

are moving fairly well. Rural-line demand is showing up well and railroads and central stations are also placing orders. Jobbers are promising three weeks' delivery on reasonable quantities.

Poles.—Jobbers have good stocks in yard, but are still having difficulty in getting the right sort of cars for shipping. Demand is becoming slower as the season advances. Base prices at mill quoted here range from $11.35 on the Western cedar 8-in., 40-ft. pole to $20 on the Northern white cedar 8-in., 40-ft. pole.

Washing Machines.—Retail demand is getting a trifle better, but is still below normal. Immediate deliveries can be made by manufacturers.

Locust Pins.—Large stocks of pins are being reduced with difficulty. Some small orders are being placed for building feeders and small extensions. The 1½-in. x 9-in. pins are quoted at $60 per 1,000 in lots of 5,000, and the 1¼-in. x 8 in. pins are quoted at $30 per 1,000.

SAN FRANCISCO

Contractors are very busy, and although their store business has considerably decreased, this is caused perhaps by a little tardiness in appreciating the sudden change from a sellers' to a buyers' market. Therefore, while the timorous are planning for a year of retrenchment, shrewder observers feel assured that 1921 will be a prosperous year for California, considering such factors as big railroad expenditures, the completion of gigantic power projects and merchandising co-operative efforts. Heavy rains have caused disastrous floods in the rice districts because of breaks in the Sacramento levees.

Shipments from the East are heavy and are coming through in good time. Few of the early back orders remain and future purchases must be figured on a basis of prompt delivery. This quick change in manufacturing conditions will doubtless pile up local stocks for a while. Collections are better, through the vigorous shepherding of the credit managers. Credit extensions are made very sparingly.

Fixtures.—Fixture business in general is good, especially in southern California, where an exceedingly large proportion of the building permits cover bungalows and other small dwellings. Clever and consistent selling effort has produced a steady call for the new patented fixtures. A big Christmas business in portables and standards with silk and parchment shades is expected. Stocks have never been so large or so well assorted.

Vacuum Cleaners.—This business is certainly far larger than it was a year ago, but whether its profits for the dealer have increased proportionately may be doubted. The number of aggressive manufacturers who promise results through vigorous campaigns has so grown that in many districts the saturation point for present clean-up methods of selling has been reached. One result has been an almost general increase in the variety of makes carried by each dealer and a consequent decrease in his rate of turnover.

Washing Machines.—The same conditions apply to the washing-machine market, where the very necessary element of turnover has been overlooked by many dealers. There is an insistent call for a searching investigation into the high overhead reported by some of the dealers who have staged the most spectacular sales efforts, and the next four weeks may reveal totally new methods of handling washer business.

SEATTLE—PORTLAND

Business was more or less uneven all during the past week, with slackness or negligible buying in some lines and a brisk volume of sales in others. Light movement was recorded in schedule materials, motors and pole-line materials, but sales of domestic appliances, portable lamps, etc., showed pleasing increases. Farm-lighting plant sales also picked up, although the volume is not nearly so large as originally predicted. Dealers who have been consistently advertising appliances are noting a steady increase in their sales. The transportation is good, cars west of Chicago coming through in splendid time.

Portland jobbers state that business is holding up. In some cases buying is brisk, although the general tendency seems to be to withhold buying awaiting further drop in prices. Heating devices are not moving so fast as a year ago. The buying of good-grade standard lighting fixtures and reflectors indicated a tendency on the part of stores, offices and factories to improve lighting conditions. Part of the present movement is traceable to the effect of the recent industrial code adopted in Oregon and part to the general educational propaganda relative to improved lighting.

The campaign relative to convenient outlets is also having its effect as indicated by the rapid increase in the demand for receptacles. Jobbers' stocks of flashlights and batteries are improving and are considerably better than they have been for at least a year. The demand for renewable fuses is increasing rapidly, particularly in the 600-volt class, while the sale of non-renewable fuses has fallen off approximately 50 per cent the past year.

Active inquiry in regard to pole-line materials indicates the probability of a great deal of work of this sort being done in the spring period. Many mills closed temporarily are taking advantage of this condition to remodel and improve, and thousands of dollars are being spent for electrical materials and equipment. Contractors and dealers report business good, and most contractors have enough work to keep them going very satisfactorily for some time.

Motors.—Demand for fractional-horsepower motors is still in excess of supply, and deliveries are exceptionally hard to obtain. The call for large motors, generally speaking, is light, although several sales to sawmills of consequence have been made during the week.

Flatirons.—Stocks are not in good condition, and deliveries are far from satisfactory. Demand is consistently good and showing material increase.

Lamps.—Stocks are in good shape and deliveries prompt. Sales volumes increased steadily all during the month, particularly on residence types.

SALT LAKE CITY—DENVER

A close analysis of the electrical trade in the Intermountain region shows that conditions are relatively stable. It is passing through a critical merchandising period along with other industries but is beset with fewer perplexing conditions than most of them. Through persistent selling tactics stocks are kept moving, though sluggishly. The general trend is hopeful, though not by any means satisfactory. The Intermountain distributing branch for one of the largest electrical manufacturing concerns in the United States reports business better here than in nearly any other section. With eight jobbing centers it moved more electrical merchandise last month than a Southern area with twenty-two jobbers.

Thus far most jobbers have been able to keep clear of financial straits. They are canceling their paper in fairly prompt order and taking their regular discounts. Dealers, however, are having a worse time of it, finding it necessary in many cases to resort to cancellation of orders. They are working to a program of fast turnovers and small quantities in stock. No one is looking for an immediate fall in prices. Jobbers are well stocked and claim to be working on a margin that would mean disaster with any material reduction of the present price schedule. They look for an ultimate recession to a normal basis, but believe the readjustment will have to come very gradually.

The market for agricultural products is in a demoralized condition in some sections. Hay that would have brought $20 a ton and upward two years ago is now waiting in storage with no demand. Farmers are showing some disposition to hold their wheat and potatoes for better prices. This is reflecting adversely on the market for electrical goods. As yet the wave of non-employment has not seriously affected the Intermountain West. This is due mainly to the relative absence of large manufacturing plants.

The prospect for a satisfactory holiday trade is a little brighter with the near approach of Christmas. Dealers are yielding more and more to jobbers' entreaties to stock.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Commercial Ceiling Fixture

One more of the new unit ceiling fixtures for commercial use has been brought out by the F. W. Wakefield Brass Company, Vermilion, Ohio. It

CHAIN SUSPENSION MAY BE USED

has been especially designed for adaptation to the Phoenix Gas Company's unit 11-8-12. The units come in 4-in. and 6-in. sizes for medium-type sockets and in 6-in. size for mogul socket.

Ironer with Automatically Shifting Shoe

By moving a small level conveniently placed at the right of the feed board the shoe of the new Thor electric ironer developed by the Hurley Machine Company, Chicago, is shifted into the closed

NEW SHIFT CONTROL USED

position or one of three open positions. Two buttons on the control lever are shifted up or down to select the position desired, and the shifting is done by the motor through gear trains, leaving the operator free to guide the pieces being ironed and making it possible for him to work while sitting down. The cylinder has two speeds, 8 ft. per minute for heavy pieces and 12½ ft. per minute for light pieces. Direct-shaft drive is used and all gears are inclosed, running in lubricant.

Electric Oven for Drying Armatures, Etc.

For drying armatures, field coils, etc., in electrical repair shops a new electric oven has been developed by the Service Station Supply Company, 30 East Larned Street, Detroit, Mich. It was originally designed for heating batteries before opening them. This "Hyrate" oven is made in two types, for 110 volts and 220 volts respectively, either direct or alternating current. A handle on each end of the oven enables it to be tipped for inspection or removal of the contents.

Vacuum-Cleaner Connector

The Bryant Electric Company, Bridgeport, Conn., has just placed on the market a new Spartan connector for use with vacuum cleaners. It is the Spartan receptacle handle connec-

FIBER AND PORCELAIN HANDLE CONNECTOR

tor No. 138, made of a heavy fiber tube longer than the porcelain connector body. The body is provided with contact slots for plug caps and binding posts for wires.

A Flush Screw Receptacle

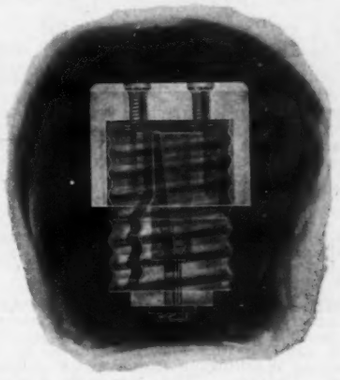
A new porcelain-base flush screw receptacle has been developed by the Paragon Electric Manufacturing Company, 679 Miami Street, Akron, Ohio. This receptacle is rated at 250 volts and 660 watts. One feature is an extra-long screw which will not fall out of the receptacle when it is being installed or connected. The shoulders are made flush with the outlet box. A long screw slot permits half an inch of play.

Loom and Armored-Cable Boxes

Two types of boxes have been developed by Clemence Brothers, 164 Linden Avenue, Irvington, N. J. The "Sterling BX box" is used for armored cable work and is made in both straight electric and combination styles. It has no clamps, the cable being gripped by two screws which will hold cables of different sizes. The "Meleady loom box" is used for knob and tube work. This box is also made for straight electric or combination work. The underwriters have approved both boxes.

Renewable Plug Fuse

The new renewable plug fuse announced by the Pierce Fuse Corporation, 752 Main Street, Buffalo, N. Y., consists of a porcelain core, a porcelain case with the brass plug shell attached, and the link of which the brass plug-end contact disk is a part. To renew the fuse no tools are needed. Contact is made by bending the link over so that as the plug is put to-

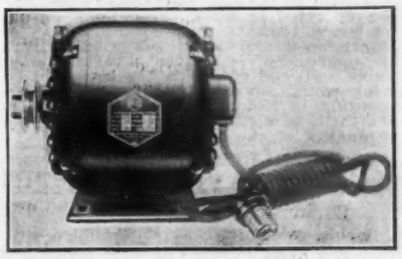


RENEWABLE FUSE WHICH HAS ONLY THREE PARTS

gether the link is engaged between the core and the brass shell of the case and held tight. To test the plug the plug-end contact disk is pulled—it will pull out if the fuse has blown. The fuse is made in the standard-plug size, with links for all capacities to 30 amp.

Fractional-Horsepower Motors

A ¼-hp. split-phase motor is being produced by the H-G Manufacturing Company, 1215 Pine St., St. Louis, Mo. Features claimed for the motor are that no live parts are exposed, that the housing is splash-proof, that special ventilation is employed and that starting torque is high with low starting current, high efficiency and power factor.



LIBERAL OVERLOAD CAPACITY CLAIMED

The motor is made with a high-carbon steel shaft, phosphor-bronze bearings and large-capacity oil wells of the wick-filled type. It is made in ¼-hp. and ⅓-hp. sizes for 110-volt and 220-volt, single-phase operation.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

JOHN KELLY has resigned as vice-president and general sales manager of the Edison Storage Battery Company, Orange, N. Y.

THE J. A. WEBB BELTING COMPANY, Buffalo, N. Y., has increased its capital stock from $25,000 to $50,000.

THE ECONOMY FUSE & MANUFACTURING COMPANY, Chicago, announces that C. B. Merrell, who has been for a number of years in the general offices of the company, has been appointed district sales manager of the Philadelphia office, 523 Widener Building, vice E. J. Watson, resigned.

THE CONNECTICUT BLOWER COMPANY, Hartford, Conn., has filed notice of active capital stock of $200,000. The company will manufacture mechanical blower apparatus.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has recently installed the largest induction feeder regulators ever built in the company's works, in the Philadelphia Electric Company's outdoor substation at the Philadelphia end of the 66,000-volt transmission line between Philadelphia and Chester. The capacity of each regulator is 1,750 k.v.a., the capacity of the largest built previous to these having been 1,000 k.v.a.

THE PEERLESS LIGHT COMPANY, manufacturer of lighting fixtures, electrical specialties, etc, has purchased the six-story building and site it occupies at the corner of Washington Boulevard and Union Street, Chicago. The company has remodeled the building to meet its requirements, at a cost of $175,000.

THE HAESE ELECTRIC COMPANY, Punputawney, Pa., is plannng to establish an office and warehouse in Wheeling, W. Va., in the near future. The company deals in mining machinery, high-voltage motors and general electrical equipment.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has awarded contract for construction of a new factory building, 160 ft. x 300 ft. at its Lynn (Mass.) plant, to cost about $150,000.

THE MEEHAN MANUFACTURING COMPANY, 709 M. & M. Building, Milwaukee, Wis., contemplates building a factory, 80 ft. x 100 ft., in Jackson, Wis., for the manufacture of farm-lighting plants. The company, it is understood, has already secured a site for the proposed plant

THE BLAW-KNOX COMPANY is planning to erect a two-story extension, 81 ft. x 90 ft., at its plant in Blawnox, Pa., for which it is understood, bids have been asked.

THE MASON REGULATOR COMPANY, Dorchester Center, Boston, Mass., has recently made a $150,000 addition to its pressure regulator factory, permitting the permanent housing of machinery which has been operated in wooden buildings during and since the war. The building is of modern steel and brick construction, and the machinery is driven by individual motors. Special emphasis has been laid on giving every advantage to the employees, according to Eldon Macleod, treasurer, so that their best efforts may be reflected in the quality of the product.

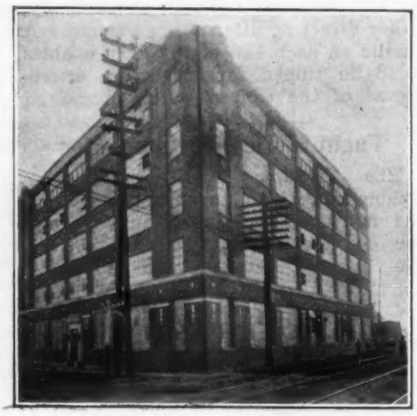
THE CHAIN BELT COMPANY, Milwaukee, Wis., announces the appointment of Clifford F. Messinger as general sales manager to succeed L. C. Wilson, who has resigned to become secretary of the Federal Malleable Company, closely associated with the Chain Belt Company. C. E. Stone has become assistant to the vice-president, and J. A. Monahan purchasing agent.

THE BRADFORD SALES COMPANY is the name of the new selling organization which has recently been formed from the Manufacturers' Sales Company by C. C. Bradford. The offices of this company, which will represent not more than two manufacturers as a district sales office of each, are at 340 Leader-News Building, Cleveland, Ohio.

THE NATIONAL LAMP WORKS of the General Electric Company, Ferry Street and Fillmore Avenue, Buffalo, N. Y., has made application to the City Council for permission to construct its proposed new two-story plant building at this location, contract for which was recently awarded. The factory will be brick and steel, 82 ft. x 132 ft., and will be equipped for the manufacture of light precision equipment as used in electric lamp production. It is estimated to cost about $120,000.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson Heights, Baltimore, announces that its net sales as of Oct. 31, 1920, are 163 per cent of the total net sales of the year 1919, and the company expects that by the end of the present year the net sales will exceed those of 1919 by almost 100 per cent.

THE WESTINGHOUSE ELECTRIC PRODUCTS COMPANY, Mansfield, Ohio, has recently completed a new five-story building which will double productive capacity. Offices will be on the fifth floor, with the warehouse on the fourth floor, connected to the shipping room on the first



WESTINGHOUSE'S NEW FACTORY FOR PRODUCTION OF HEATING DEVICES

floor by means of a spiral chute. The second and third floors are devoted to electric ware assembly. In addition to the new building a third floor is being added to the older building which will be used as a cafeteria.

W. S. QUIGLEY, president of the Quigley Furnace Specialties Company, New York City, has just returned from Europe after an extensive trip made in connection with large installations of the Quigley powdered-coal system in Italy and Belgium.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has moved the sales and service offices of the automotive equipment department, previously at New York and East Pittsburgh respectively, to 82 Worthington Street, Springfield, Mass.

THE ELECTRIC SPECIALTY COMPANY, Louisville, Ky., has applied for an increase in capital from $5,000 to $35,000.

GEORGE H. WALBRIDGE and LYMAN P. HAMMOND have opened an office at 120 Broadway, New York City, and will undertake special executive work in the investigation, organization, reorganization and financing of public utility and industrial corporations for various investment and commercial banking institutions. They have resigned as vice-presidents of Bonbright & Company, Inc., but continue as active officers of the Colorado Power Company, the Arizona Power Company, Pacific Gas & Electric Company of Phoenix and as directors of other public utility and industrial corporations in which Bonbright & Company are interested.

THE ADVANCE ELECTRIC COMPANY, St. Louis, Mo., has decreased its capital stock from $150,000 to $110,000.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has increased its capital stock from $2,800,000 to $3,000,000.

F. M. THEBO and R. C. STARR have formed the firm of Thebo & Starr, engineers and contractors, Sharon Building, San Francisco, Cal., to specialize in hydro-electric and irrigation projects, appraisals, investigations, design and construction. R. C. Starr still remains as construction engineer in charge of hydro-electric construction and design for the San Joaquin Light & Power Corporation, Fresno, Cal.

THE IDEAL ELECTRIC & MANUFACTURING COMPANY, Mansfield, Ohio, has arranged with the Baker-Joslyn Company, 183-199 First Street, San Francisco, Cal., as head office, with offices and warehouses in that city, Seattle and Los Angeles, to handle its products on the Pacific Coast. The company's new factory, now under construction in Mansfield, will triple the production.

THE SAFETY CAR HEATING & LIGHTING COMPANY, 206 Erie Street, Jersey City, N. J., has completed the removal of its plant to its new works at New Haven, Conn., comprising a number of buildings formerly occupied by the Marlin-Rockwell Corporation. The lamp and mantel department is still being operated at the Jersey City works and will not be removed to the new location until the spring of the coming year, when suitable quarters will be arranged for occupancy under increased output.

THE OHIO GREASE COMPANY, Londonville, Ohio, announces that R. W. Beardsley has been elected treasurer. The capital stock has been increased from $250,000 to $500,000 and a large addition to the factory has been finished which will triple the capacity.

Supply Jobbers' Notes

THE REQUA ELECTRICAL SUPPLY COMPANY, Rochester, N. Y., announces the appointment of H. L. Ball as sales manager. Mr. Ball held the same position with the Rochester Electric Supply Company for the last three years, and during the twelve years previous he was with the Westinghouse Electric Manufacturing Company in a sales and engineering capacity. The company has recently opened an apparatus department to handle motors and similar equipment.

J. E. McCLERMON has resigned as president of the Northwestern Electric Equipment Company, electrical supply jobber at 35 Vestry Street, New York City, to look after personal interests in the West, for which section he is leaving the early part of December.

Foreign Trade Notes

BOLIVIAN ELECTRICAL IMPORTERS.—List L. A. 11014 of importers of electrical apparatus and supplies in Bolivia has been received by the American Manufacturers' Export Association. This list is available at the New York office of the Bureau of Foreign and Domestic Commerce, Custom House.

AMERICAN COMPANIES BUILDING IN TORONTO.—The Coruse-Hinds Company of Canada, Harvey Hubbell and the Hubbell-Mack Machine Screw Company have purchased five acres of land in Toronto, Canada, and will erect a three-story brick, concrete and steel building for producing electric fixtures, machine screws, conduiets, switches and panels. Cost will approximate $500,000.

CENTRALIZATION OF DANZIG'S ELECTRICAL SUPPLY CONTEMPLATED.—The Council of State has submitted to the Constitutional Assembly a project providing for the creation of an electricity board whose duties would cover all questions connected with the free city's supply of electric current. The ultimate object in view is the creation of a central authority empowered to regulate all questions connected with the production and distribution of electricity for light and power. According to certain versions, the acquisition of all power plants by the future free city government is contemplated.

GERMAN FIRM GETS BRITISH CONTRACTS.—The A. E. G. of Berlin has just taken a contract worth from £155,000 to £200,000 to equip a plant in the north of England with generators, motors, switchboards and other electrical equipment.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm of manufacturers' agents in South Africa (No. 34,044) desires to secure an agency on a commission basis for the sale of electrical goods, such as heating and cooking appliances, fans, lamps, wiring appliances and fittings.

A company of commercial representatives in Mexico (No. 34,045) desires to secure exclusive agencies for the sale of electrical equipment, such as generators and supply parts, etc.

Trade Publications

FANS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued a new bulletin, No. 3512, listing Emerson alternating-current ventilating fan motors, designed for vertical or horizontal discharge.

PUMPS.—The Duriron Company, Dayton, Ohio, has issued bulletins 112, 115 and 116 on single-stage centrifugal pumps, acid-resisting.

HEATERS.—The Ross Heater & Manufacturing Company, Buffalo, N. Y., is circulating catalog F on Ross instantaneous and storage liquid heaters, condensers, coolers, evaporators and expansion joints.

MOTORS.—American Radio & Research Corporation, New York City, has published Bulletin A on "Fractional Horse-Power Alternating-Current Motors."

RADIO.—The American Radio & Research Corporation, New York City, is distributing bulletin R on "Amrad Standard Parts" for radio builders.

New Incorporations

THE LOUISVILLE ELECTRIC MANUFACTURING COMPANY, Louisville, Ky., has been incorporated with capital stock of $75,000 by C. E. Wiley, J. E Willey and William Watts. The factory will be erected at Thirty-first and Magazine Streets to produce portable electric tools.

THE NEW ADVANCE MACHINERY COMPANY has been incorporated with a capitalization of $100,000, by business men of Van Wert, Ohio, who purchased the plant and interests of the Advance Machinery Company on Sept. 8 at receiver's sale. The new owners will conduct the business along modern lines. The following officers have been elected: W. H. Dailey, president and general manager; H. M. Gee, vice-president, and F. W. Fraylick, secretary and treasurer.

THE ISKO ELECTRIC COMPANY, Tulsa, Okla., has been incorporated with a capital stock of $100,000 by E. R. Kemp, R. H. Hardin and Edgar A. De Neules.

THE ORIOLE SPECIALTY CORPORATION, Belair Road and Southern Avenue, Baltimore, Md., has been incorporated by Thomas Heur, Charles B. Mills, and Harry L. Robinson. The company is capitalized at $100,000 and proposes to do an electrical and mechanical engineering business.

THE F. V. L. SMITH BATTERY COMPANY, Atlanta, Ga., has been chartered with a capital of $300,000 to manufacture electric batteries; also to establish a chain of general service stations. F. V. L. Smith is president and S. L. Munson is secretary of the company.

THE EMCO SALES CORPORATION, Buffalo, N. Y., has been chartered by W. F. Emerson, W. C. Carroll and I. Rabinowitz, Buffalo. The company is capitalized at $25,000 and proposes to manufacture electrical appliances.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BAR HARBOR, ME.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the erection of radio buildings at this place. (Specification 4333.)

SPRINGFIELD, MASS. — The United Electric Light Company, 73 State Street, is considering the erection of a new substation at Boulevard and Rose Street, East Springfield (Springfield P. O.). McClintock & Craig, 33 Lyman Street, are electrical engineers.

SPRINGFIELD, MASS. — Permit has been granted to the Diamond Match Company, Howes Street, for the erection of a power house to cost about $110,000.

FAIRFIELD, CONN.—The DuPont Fabrikoid Company plans to increase its substation capacity to 100 kva. and the motor load by 250 hp.

Middle Atlantic States

LAKE GEORGE, N. Y. — The cottage colony on the east side of Lake George, in the town of Caldwell, is considering the establishment of a lighting district.

LIVERPOOL, N. Y.—A resolution was adopted at a meeting of the Liverpool Improvement Association to investigate the advisability of establishing a municipally-owned lighting system and distributing plant.

NEW YORK, N. Y.—Plans have been filed by the Department of Public Welfare for the erection of a power house at the Metropolitan Hospital, Blackwell's Island, to cost about $25,000.

BELVIDERE, N. J.—W. C. Albertson and S. L. Mershon, care of Fort, Hunt & Shipmen, 31 Clinton Street, Newark, have applied for permission to erect a power house, dam and transmission lines on the Delaware River at Foul Rift (Belvidere P. O.).

EAST ORANGE, N. J.—The city officials are considering plans for an extension to the street-lighting system recently installed in a portion of the business section.

NEWARK, N. J.—The Duratex Company, 134 Frelinghuysen Avenue, contemplates the erection of a power house at its leather manufacturing works to cost about $30,000.

ALTOONA, PA.—The City Commissioners contemplate the erection of a reservoir, including two electrically driven automatically controlled pumps, etc., to cost about $20,000. H. G. Hinkle is city manager.

PITTSBURGH, PA.—The Board of Trade has recommended the installation of cluster lights on certain streets and avenues of the city.

WAYNESBORO, PA. — The Council is considering the establishment of a hydro-electric plant at this place. Surveys of sites and water facilities are being made by Borough Engineer Payne.

BALTIMORE, MD.—An appropriation of $1,150,000 was voted at a recent election for construction of additions and extensions to the conduit system for electric light, telegraph and telephone wires.

BALTIMORE, MD. — Considerable electrical equipment will be installed in the new state hospital for colored persons to be erected by the State Hospital Commission, Annapolis, on a site near Baltimore, to cost about $500,000.

BALTIMORE, MD.—The Baltimore Car & Foundry Company has filed plans for a new power house at its plant at Curtis Avenue and Locust Street, Curtis Bay (Baltimore P. O.), to cost about $20,000.

BALTIMORE, MD.—The Coca-Cola Company, Pratt and Concord Streets, contemplates the establishment of a power plant for factory service in connection with its proposed new plant at Fort Avenue.

BALTIMORE, MD.—The Northern Maryland Electric Company recently organized as a subsidiary of the Consolidated Gas, Electric Light & Power Company, Lexington Building, has applied to the Public Service Commission for permission to issue $86,000 in securities, the proceeds to be used for extensions and betterments to its plant in the vicinity of Clark's Ferry. Plans include the installation of new overhead and underground lines, the erection of a new transmission line from Sylmar to Rising Sun and the connection of its Sylmar lines to existing utility systems in the Oxford section.

North Central States

CHEBOYGAN, MICH.—The city officials contemplate the installation of a pumping and power unit for the water-works to cost about $72,000.

DETROIT, MICH.—The Board of Education, 50 Broadway, will receive bids until Dec. 21 for the erection of a technical high school to cost about $2,500,000. Electric light equipment and power equipment for shops will be installed.

DETROIT, MICH.—The Detroit Packing Company, 40 Bushey Street, contemplates the establishment of a power plant in connection with its proposed packing plant to be erected at a cost of about $1,000,000. The Packers' Architectural & Engineering Company, Manhattan Building, Chicago, Ill., is architect and engineer.

IRONWOOD, MICH.—According to the officials of the Ironwood & Bessemer Railway & Light Company, the erection of a power plant on the Flambeau River to generate 20,000 hp. is contemplated at a cost of about $3,999,000.

OAKWOOD, MICH.—The Detroit Rock Salt Company contemplates the erection of a 38-ft. x 45-ft. boiler house and power plant.

CLEVELAND, OHIO.—Bids will be received by C. M. Osborn, city manager of East Cleveland (Cleveland P. O.), until Dec. 15 for furnishing about 1,000 electric light poles and electric wire.

MURRAY, KY.—The power plant of the Murray Light & Power Company, it is reported, has been destroyed by fire, causing a loss of about $75,000.

TAYLORVILLE, KY.—It is reported that a recent fire destroyed the local power plant owned by M. S. Cheek, also his garage and blacksmith shop, causing a loss of about $15,000.

WAUKEEGAN, ILL.—Contract will soon be awarded by the Victory Memorial Hospital, care of Schmidt, Gardner & Mortin, architects, 104 South Michigan Street, for the erection of a hospital and power house to cost about $300,000.

LA CROSSE, WIS. — The Wisconsin-Minnesota Light & Power Company, 120 North Fifth Street, contemplates the erection of a 10,000-kw. steam power plant to cost about $50,000. Plans also include the extension of electric lines to Hokah, Minn., and Sparta, Wis. F. G. Felton is manager.

DULUTH, MINN.—The Great Northern Power Company, Superior Street and Fifth Avenue, West, is having preliminary surveys and plans made for the construction of a power plant on the St. Louis River to cost between $1,000,000 and $2,000,000.

KIRKMAN, IOWA.—At a recent election bonds to the amount of $6,000 were carried for an electric light system. E. B. Tucker is city clerk.

MOUNT VERNON, MO.—The Lawrence County Water, Light & Cold Storage Company, Aurora, is negotiating for the purchase of a municipally owned water and light plant at this place. The company is also contemplating the installation of a lighting system at Crane.

TYNDALL, S. D.—Arrangements have been made for the issue of $50,000 in bonds for the erection of an electric light plant.

Southern States

SCOTLAND NECK, N. C.—The city officials contemplate the installation of a new electric light system to cost about $50,000.

SPRUCE PINE, N. C.—Col. D. W. Adams, Old Fort, is promoting a hydro-electric project to be developed on the Toe River near this place at a cost of several hundred thousand dollars.

WILMINGTON, N. C.—It is reported that a recent fire damaged the power plant and other departments of the Widemer Lumber Company, causing a loss of about $100,000.

MONTGOMERY, ALA.—The State Public Service Commission has granted a writ of convenience to the Alabama Power Company, Birmingham, for the construction of a hydro-electric plant and dam near Lock 12 on the Coosa River.

McCOMB, MISS.—A special election will be held on Dec. 2 for the purpose of submitting to the voters a proposition to issue $200,000 bonds for the erection of an electric light and power plant.

PASCAGOULA, MISS.—The Navy Department, Washington, D. C., contemplates the extension of the naval reservation at this place. Plans include the erection of a 40-ft. x 80-ft. power house and several other buildings.

DALLAS, TEX.—The officials of the city and county of Dallas contemplate the erection of a hospital to cost about $450,000. Plans include installation of X-ray equipment.

EL PASO, TEX.—The El Paso Electric Railway contemplates the expenditure of $1,029,000 for extensions and improvements as follows: Installation of a 7,500-kw. turbine for power plant $785,000; short-line extension, $60,000; high-tension buses and switches, $10,000; additional high-tension transformers, $30,000; miscellaneous power-plant items, $3,700, etc.

PORT ARTHUR, TEX.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 15 for the erection of a 14-ft. x 39-ft. radio building at this place.

Pacific and Mountain States

SAN FRANCISCO, CAL. — The Electro Metals Company, 729 Call Building, has applied for permission to divert 300 sec.-ft. of water from Salmon River for power purposes. Plans include the erection of a power house, dams, etc. W. G. Devereaux is president.

SAN FRANCISCO, CAL. — J. G. Van Zandt, care of W. L. Huber, First National Bank Building, has applied for permission to develop a power project on Bear and Santa Anna Creeks.

SAN FRANCISCO, CAL. — The Snow Mountain & Power Company, care of Pillsbury, Madison & Sutro, Standard Oil Building, has applied for permission to erect dams, transmission lines, install conduits, etc.

STOCKTON, CAL.—The Western States Gas & Electric Company has applied for right-of-way for the erection of transmission lines and permission to enlarge the American River conduit. H. M. Byllesby & Company, are engineers.

WILLIAMS, CAL.—R. G. McDonald has applied for permission to erect two power houses, transmission lines, etc., at Convict Creek, for mining and pumping purposes.

FORT KLAMATH, ORE. — Application has been made by the Fort Klamath Meadows Company for permission to appropriate water from Anna Creek for power purposes. Plans include the installation of a Pelton turbine waterwheel and a dynamo. The cost of the installation is estimated at $50,000.

FILLMORE, UTAH. — The Telluride Power Company, 415 Walker Bank Building, Salt Lake City, has plans under way for the extension of its power line for pumping purposes from this place through the artesian-well belt, McCormack and other adjoining towns.

NEPHI, UTAH.—The Big Springs Electric Company, Fountain Green, is negotiating with the town officials of Levan for the extension of the company's lines down the Nephi canyon to that place.

PROVO, UTAH.—F. W. C. Hathenbruck has filed application with the State Engineer for permission to divert 6 sec.-ft. of water from the subsoil flow in Slate Canyon to operate a 300-hp. hydro-electric plant for mining purposes at this place.

HAXTUN, COL.—The city officials have plans under way for the erection of an extensive addition to the light and power plant.

Canada

ROLAND, MAN.—A bylaw was recently passed authorizing the extension of the provincial hydro-electric power system to this place. J. M. Leamy, Winnipeg, is power commissioner.

LONDON, ONT.—The Utilities Commissioners will have plans prepared for the erection of a substation on Cabell Street to cost about $85,000. Plans include the installation of transformers, generators, switches, etc. E. V. Buchanan, Hydro offices, is engineer.

MONTREAL, QUE. — The governors of McGill University, Sherbrooke Street, West, contemplate extensions to the mining and electrical building to cost about $500,000.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 16, 1920)

14,984 (reissue). ELECTRIC BATTERY; Harry F. French, Fremont, Ohio. App. filed May 13, 1919. Elements kept separated until put into action.

1,358,691. COMMUTATOR CYLINDER; Vero M. Allen, Cantley, England. App. filed Nov. 1, 1917. Large number of bars in cylinder of given diameter.

1,358,701. PROTECTIVE MEANS FOR CONTACT TERMINALS; Clarence A. Boddie, Pittsburgh, Pa. App. filed Nov. 9, 1918. For a voltage regulator.

1,358,704. CONTROL SYSTEM; Andrew H. Candee, Pittsburgh, Pa. App. filed May 2, 1917. Electric railway vehicle.

1,358,713. AUTOMATICALLY CONTROLLED VAPOR-CONVERTER SUBSTATION; Edward P. Dillon, Wilkinsburg, Pa. App. filed Sept. 9, 1916. Controlled by clock.

1,358,717. FLASHLIGHT BATTERY; Nathaniel D. Forbes, West Haven, Conn. App. filed April 13, 1920. Cells in case.

1,358,718. ELECTRICAL PROTECTIVE DEVICE; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Oct. 6, 1916. Prevents damage by high temperature.

1,358,720. SIGNAL SYSTEM AND APPARATUS; Herbert M. Friendly, Portland, Ore. App. filed Nov. 23, 1915. Telephone.

1,358,731. BRANCH CONNECTOR FOR ELECTRIC CONDUCTOR; William A. Harvey, Scranton, Pa. App. filed Feb. 25, 1918. Replaces spliced joint.

1,358,735. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed April 18, 1917. Several motors on one load.

1,358,736. COMMUTATOR CYLINDER; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 10, 1917. Means for connecting conductors to bars.

1,358,737. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 24, 1916. Railway vehicle.

1,358,738. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 24, 1916. Regenerative.

1,358,758. TELEPHONE TRUNK CIRCUITS; George W. Kuhn, Brooklyn, N. Y. App. filed July 12, 1917. For testing.

1,358,769. CONTROL APPARATUS; Paul L. Mardis, Altoona, Pa. App. filed June 4, 1915. Prevents abuse of motor.

1,258,790. CONTROL SYSTEM FOR VENTILATING APPARATUS; Wirt S. Scott, Edgewood Park, Pa. App. filed May 23, 1919. For enameling ovens.

1,358,809. DYNAMO-ELECTRIC MACHINE; Charles E. Wilson, Wilkinsburg, Pa. App. filed May 4, 1916. Poles bolted on.

1,358,811. ADJUSTABLE CLUSTER FOR ELECTRIC LIGHT FIXTURE; Lauritz W. Anderson, Waterbury, Conn. App. filed April 25, 1918. For table lamps.

1,358,839. BATTERY HAND LAMP; George D. Gallagher, Washington, D. C. App. filed June 8, 1920. Flashlight.

1,358,858. DIAPHRAGM FOR ELECTROLYTIC CELLS; Milo W. Krejci, Chicago, Ill. App. filed Jan. 16, 1920. Compressed vitrified filaments.

1,358,896. RECORDING DEVICE; Charles B. Thwing, Philadelphia, Pa. App. filed Nov. 30, 1918. For insuring return of needle of recording galvanometer to zero.

1,358,900. AUTOMATIC HEATER AND HOLDER-ON FOR RIVETS FOR RIVETING PURPOSES; John C. Van Haagen, Philadelphia, Pa. App. filed Dec. 17, 1919. Rivets in magazine heated singly just before driving.

1,358,901. ELECTRICAL SYSTEM; Thomas W. Varley, New York, N. Y. App. filed Aug. 9, 1916. Engine ignition.

1,358,945. MEASURED-SERVICE TELEPONE SYSTEM; John Erickson, Chicago, Ill. App. filed Sept. 18, 1918. Coin box.

1,358,963. SHOE FORM; Patrick J. McGrath, Brooklyn, N. Y. App. filed Feb. 24, 1920. Electrically heated for drying.

1,358,982. AUTOMATIC HEATER FOR WATER AND OTHER LIQUIDS; Antonio Papini, Philadelphia, Pa. App. filed April 26, 1920. Carbon cylinders in series with heating coil.

1,358,992. APPARATUS FOR RECTIFYING HIGH-TENSION ALTERNATING CURRENTS; Walter A. Schmidt, Los Angeles, Cal. App. filed June 22, 1916. For precipitation of suspended particles.

1,359,000. EVAPORIZER; Carl L. Stottmeister, New York, N. Y. App. filed Dec. 18, 1919. For perfumes, medicine, etc.

1,359,001. METHOD OF MANUFACTURING ELECTRICALLY WELDED TUBING; Richard Stresau, Wauwatosa, Wis. App. filed July 17, 1920. From sheet metal.

1,359,002. ELECTROLYTIC CELL; Bruno Thomas, Seattle, Wash. App. filed June 10, 1918. Construction allows continuous action.

1,359,023. CALL BOX; Samuel R. Boone, Baltimore, Md. App. filed July 2, 1919. For bank tellers, etc.

1,359,061. TELEPHONE RECEIVER; Erich Hausdorf, Berlin, Germany. App. filed Nov. 7, 1919. Placed on the ear, not held.

1,359,067. ARRANGEMENT OF ELECTRIC FURNACE ELECTRODES; Thorleif M. Hvidsten and Arne H. Ingelsrud, Christiania, Norway. App. filed March 19, 1919. Three-phase arc.

1,359,134. STEM AND MOUNT FOR INCANDESCENT-LAMP FILAMENTS; Miner P. Wetmore, Newark, N. J. App. filed July 18, 1918. For automobile headlamps and gas-filled lamps.

1,359,143. GENERATOR DISCONNECTOR BOX; John A. Amos, Chicago, Ill. App. filed June 27, 1918. Railway.

1,359,171. ELECTRIC ATTACHMENT PLUG; Max Herskovitz, Chicago, Ill. App. filed Jan. 11, 1918. Not disassembled when connecting wires.

1,359,199. MACHINE AND METHOD FOR ELECTRIC HEATING FOR UPSETTING AND FORMING; Ernest Riemenschneider, Highland Park, Mich. App. filed June 7, 1920. Heat only where needed.

1,359,201. DRY BATTERY; William H. Sheahan, Philadelphia, Pa. App. filed Dec. 13 1918. Not subject to deterioration during non-use.

1,359,211. PROCESS OF AND APPARATUS FOR PRODUCING PHOSPHORIC ACID AND COMPOUNDS OF THE SAME; Frank S. Washburn, Rye, N. Y. App. filed April 21, 1919. Utilizing gaseous products from electric furnace.

1,359,222. CURRENT INTERRUPTER FOR ELECTRIC CIRCUITS; Charles E. Bennett, Atlanta, Ga. App. filed May 19, 1919. Gap for lightning arrester.

1,359,259. ELECTRIC STORAGE BATTERY; Matthew Lechner, New York, N. Y. App. filed July 29, 1918. Supports for plates.

1,359,273. ELECTROPLATING APPARATUS; Forrest G. Purinton, Waterbury, Conn. App. filed Feb. 25, 1920. Plating barrel.

1,359,274. ELECTRIC SIGN; William Recke, New York, N. Y. App. filed Oct. 30, 1916. Face of many changeable elements.

1,359,275. ELECTRIC STOVE; William P. Robertson, New York, N. Y. App. filed July 5, 1918. Folded into compact form.

1,359;280. DETACHABLE CONNECTOR; Edward Schwartz, New York, N. Y. App. filed Oct. 10, 1918. Connects cable ends.

1,359,300. X-RAY TUBE; Edmund Wander, Chicago, Ill. App. filed July 21, 1919. Heating unit and regulator.

1,359,310. DETECTOR CONDENSER; John J. Aurynger, Brooklyn, N. Y. App. filed June 24, 1918. Radio receiver.

1,359,369. ELECTRIC CIGAR-LIGHTER TIP; Franklin H. Hart, New Haven, Conn. App. filed Jan. 15, 1920. Heated coil in screw plug.

1,359,390. ELECTRIC PERCOLATOR; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Feb. 1918. Used in an ordinary coffeepot.

1,359,400. ELECTRIC HEATER; Edwin N. Lightfoot, New York, N. Y. App. filed June 22, 1920. Resistor in tubular jacket.

1,359,463. TELEGRAPH TRANSMITTER; Edwin H. Piersen, Topeka, Kan. App. filed June 1, 1915. Movements of keyboard recorded and released later to form characters.

1,359,469. CIGAR LIGHTER; Mathew Spinello, Kansas City, Mo. App. filed March 14, 1919. Electric.